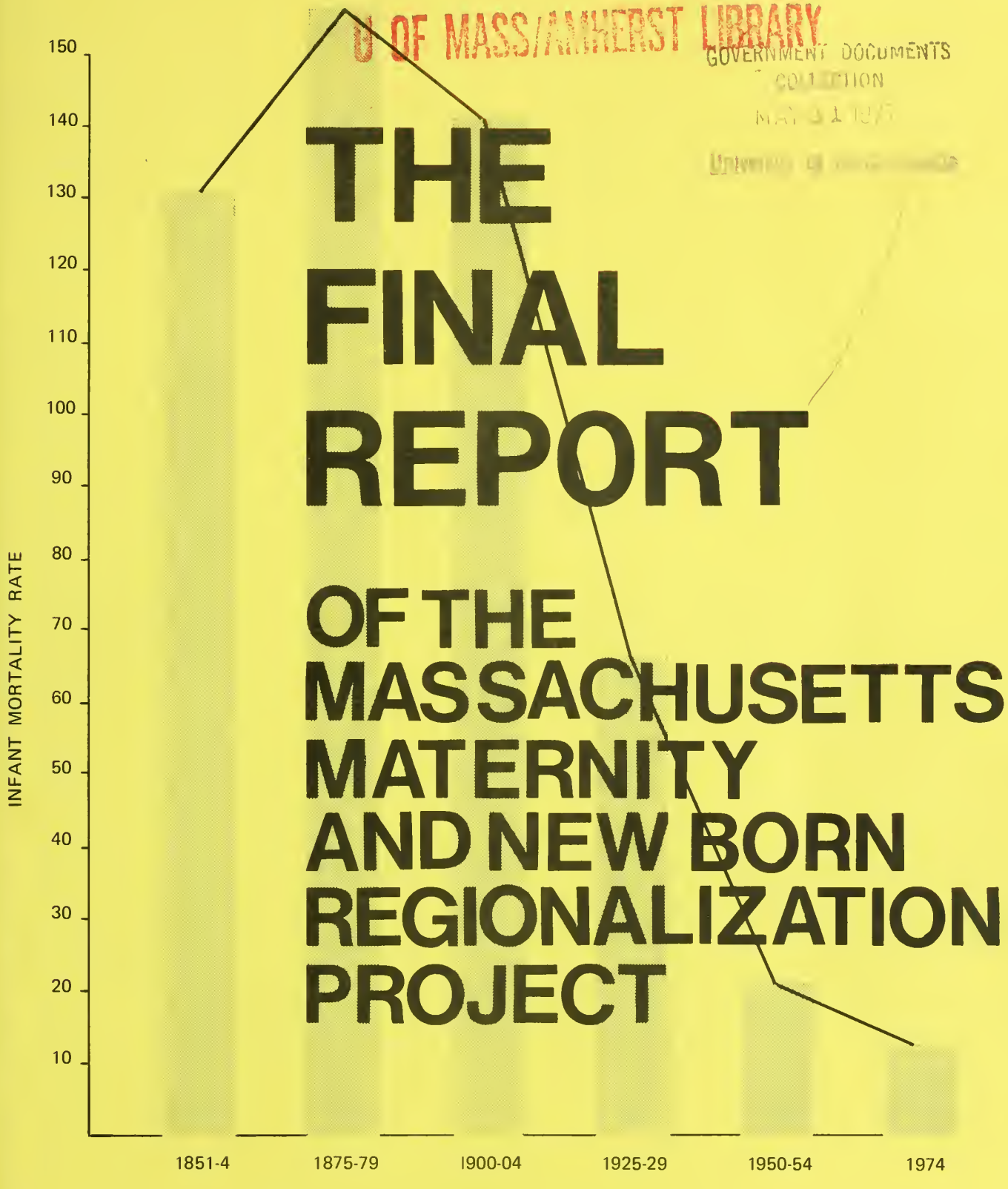
THE FINAL REPORT

OF THE MASSACHUSETTS MATERNITY AND NEW BORN REGIONALIZATION PROJECT



REGIONALIZATION OF MATERNITY AND NEWBORN CARE IN MASSACHUSETTS

FINAL REPORT

Condensed Version

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All findings, opinions and recommendations contained in this study are those of the Project and should not be construed as representing the policies or recommendations of other agencies or institutions.

ACKNOWLEDGMENTS

The Maternity and Newborn Project has been a broad based, multidisciplinary effort involving a variety of individuals, agencies and organizations concerned with maternity and newborn care. The Project has attempted to coordinate and utilize the expertise of these various resources to improve the quality and utilization of maternity and newborn services in Massachusetts. We would like to thank all of the consultants (physicians, nurses and other individuals), hospitals, task force members, state agencies, professional associations, academic institutions, planning agencies and the many others who have contributed so much time and effort to this Project.

PREFACE

The Massachusetts Maternity and Newborn Regionalization Project has made a significant contribution towards the regional development of perinatal health systems in Massachusetts. The integration of clinical and health planning concerns makes this a unique effort with widespread applications.

The project involvement with a variety of organizations, agencies, and individuals concerned with maternity and newborn care has led to the development of a board base regional program to improve the quality and utilization of perinatal care. This is an example of the progress which can be made through the cooperative efforts of public and private interests. The Department of Public Health has played an important role in the development of this project and is committed to the continuation of efforts to assure high quality perinatal care.

The project provides an approach which can be utilized in addressing other types of tertiary health care needs on a statewide basis. The Department of Public Health, working with the Health Systems Agencies, medical schools, hospitals and private agencies throughout the state, plans to devote considerable resources to similar planning efforts in other medical areas. This process will be coordinated by the Office of State Health Planning, this Department's unit responsible for development of the State Health Plan under P.L. 93-641.

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Mass. Commissioner of Public Health

CONTENTS

CHAPTER I

INTRODUCTION AND HISTORY

SECTION A - INTRODUCTION

Regionalization of perinatal care is an effort to organize efficient and effective systems for the delivery of perinatal services within a defined geographic area so that all mothers and newborns have adequate access to a full range of high-quality services appropriate to their needs. The evolution of regional programs over the past ten years has resulted from a variety of concerns over quality, organization and costs of perinatal services.

Significant numbers of maternal, perinatal and neonatal deaths in the U.S. are preventable.[1,2,3,4] Furthermore, certain groups in the U.S. do not receive even minimal maternity and newborn care and these groups have excessively high mortality and morbidity rates.[5] Maternal, perinatal and infant mortality can be substantially reduced in the U.S. through improvements in the quality, availability and organization of maternity and newborn services.

During the 1960's there were significant clinical and technological advances in the prevention, diagnosis and treatment of many maternal, fetal and newborn disorders.[6,7] Application of these advances has led to the establishment of specialized neonatal intensive care units (NICU's) throughout the country for the care and treatment of high-risk newborns. Similar programs have developed for the intensive care of high-risk obstetric patients. At the present time, the emphasis is on multidisciplinary, perinatal centers where integrated programs of specialized maternal, fetal and newborn care are provided by a wide range of health professionals and specialists.

Not all hospitals can, or should, provide a full range of perinatal intensive care services; and the majority of births will continue to occur in community hospitals which do not have these services. Therefore, many neonatal and perinatal high-risk centers have developed close working relationships with community hospitals and physicians in order to reach patients in need of intensive care, to disseminate knowledge about current practices and advances in perinatal care, and to improve the overall quality of care at the community level.

These efforts have led to the evolution of regional neonatal and perinatal programs.[2,8] Regional programs have emphasized: early identification of high-risk mothers and newborns; organized referral networks; transport of high-risk patients who require specialized services or intensive care; active communication, consultation, and educational programs between perinatal centers and community hospitals; and mechanisms for review and evaluation of perinatal care.

Dramatic reductions in neonatal and perinatal mortality and morbidity have resulted from the development of intensive care units and regional neonatal and perinatal programs.[2,9,10,11] These programs have particularly benefited high-risk patients. However, they have also improved the quality and availability of care for low-risk and normal patients as well.

The concept of regionalization has been endorsed by many groups and organizations, including the American College of Obstetricians and Gynecologists,

the American Academy of Pediatrics, the American Medical Association and the American Academy of Family Physicians. Recently, these groups have collaborated to produce the most definitive statement to date on perinatal regionalization - "Toward Improving the Outcome of Pregnancy: Recommendations for the Development of Perinatal Health Services."[11,12]

In addition to issues of quality of care, there have been growing concerns over the disorganization, inefficient utilization and high costs of medical care in recent years. These problems have been especially acute for maternity and newborn services due to rapidly declining birth rates.

As a result, State and Federal legislatures created an unprecedented number of health programs during the 1960's and 1970's in an effort to promote more effective planning and development of health services. These include State Certificate of Need Programs, the Regional Medical Program, the Comprehensive Health Planning Act of 1966 and its successor, the National Health Planning and Resources Development Act of 1974.

All of these programs and trends have played an important role in promoting higher quality, better organization and more efficient utilization of perinatal services, and have strengthened efforts to promote regionalization of perinatal care.

SECTION B - HISTORY OF REGIONALIZATION EFFORTS IN MASSACHUSETTS

Over the years many individuals and groups have helped to improve the quality, organization and delivery of maternity and newborn services in Massachusetts.

Individual physicians, representatives of medical specialty groups, and the Maternal and Perinatal Welfare Committees of the Massachusetts Medical Society have provided outstanding leadership in upgrading the quality of obstetrical and newborn care and promoting the concept of regionalization. The Perinatal Welfare Committee conducted a major study of perinatal deaths in 1967-68 which documented many problems and concluded that 35% of the deaths were preventable.[3] Subsequently regional educational programs were organized, and the Medical Society adopted a statement in support of "Centralized Community or Regionalized Perinatal Intensive Care" in 1972.

Medical institutions and the Massachusetts Hospital Association have also made a significant contribution to regionalization efforts. A number of Massachusetts hospitals have been actively involved in the development and application of technological and clinical advances in high-risk perinatal care. As a result, neonatal intensive care units evolved in Boston and Springfield during the 1960's. In Region I, a comprehensive regional neonatal program began in the early 1970's. Other centers have provided a variety of educational, consultation and transport services for community hospitals.

The Massachusetts Department of Public Health has played a key role in providing leadership and coordination for the activities of the many agencies, institutions and individuals involved in improving the quality, organization and delivery of maternity and newborn services in Massachusetts.[13] The Department has developed and administered a variety of maternal and child health programs. In

1969, the Department convened two multidisciplinary task forces which developed standards for maternity and newborn services to be used as new regulations for the licensure of maternity and newborn services in hospitals and as conditions of participation in the State Medicaid Program.[14,15] These regulations laid the foundation for official designation of different levels of newborn care, encouraged the identification and transfer of high-risk newborns, upgraded the quality of maternity and newborn services in hospitals, and generally stimulated the development of regional maternity and newborn programs.

Duplication of services and inefficient utilization of perinatal services have also been of concern. These problems are particularly acute in Massachusetts due to rapidly declining numbers of births and rapidly escalating costs of medical care over the past decade. Therefore, Federal and State programs designed to promote more efficient planning, utilization and cost effectiveness of health services have had a significant impact on regionalization of perinatal care in Massachusetts.

As a result of the Federal Comprehensive Health Planning Act of 1966, Massachusetts was divided into eight officially designated health planning regions, and state and regional health planning agencies were established. This structure has been only slightly modified by the National Health Planning and Resources Development Act of 1974. These health planning regions and agencies have provided a basis for the regional development of maternity and newborn services.

State and regional health planning agencies have collected data and information on perinatal services, and have developed standards and criteria for the planning and utilization of these services.[16,17, 32] In 1972, the Massachusetts Blue Cross, in conjunction with the Massachusetts Department of Public Health, conducted a "Statewide Maternity Study" which documented maternity service utilization for the State and each planning region.[18] Additional data on patient origin, transfers, mortality, etc. have been collected by the Massachusetts Department of Public Health and the Massachusetts Hospital Association.

In 1972, the State Legislature adopted a Determination of Need Law which controls the development and expansion of health facilities and services. The program is administered by the State Department of Public Health and has played an important role in promoting consolidation and more rational planning of maternity and newborn services. The Determination of Need Program and the new powers under the National Health Planning and Resources Development Act provide strong mechanisms for enforcement of health planning and utilization standards for perinatal services in Massachusetts.

SECTION C - MASSACHUSETTS MATERNITY AND NEWBORN PROJECT

Although Massachusetts has made progress in improving the quality and organization of perinatal care, efforts to regionalize perinatal services have been somewhat fragmented and uncoordinated. Therefore, in 1974, the Tri-State Regional Medical Program funded a project entitled "Regionalization of Maternity and Newborn Care in Massachusetts." The Project has worked with a wide variety of groups and individuals to mobilize available resources and to promote more effective coordination and integration of clinical, planning, economic and regulatory activities related to perinatal care (Appendix I-B). This Report summarizes the activities of this Project.

APPENDIX I-B

ORGANIZATIONS, AGENCIES AND INDIVIDUALS WORKING WITH THE MASSACHUSETTS MATERNITY AND NEWBORN REGIONALIZATION PROJECT

1. STATE HEALTH DEPARTMENT

   State Health Planning Agency
   Division of Standards and Regulation
   Division of Family Health Services
   Office of Health Statistics and Analysis
   Office of Health Facilities Development

2. OTHER GOVERNMENT

   Office of State Planning
   Regional Office of HEW
   State Rate Setting Commission

3. UNIVERSITIES

   Harvard School of Public Health
   University of Massachusetts Department of Public Health
   Massachusetts Institute of Technology

4. MEDICAL SPECIALTY GROUPS

   State representatives of the American College of Obstetricians and Gynecologists
   State representatives of the American Academy of Pediatrics and its Committee on the Fetus and Newborn
   State representatives of the American Academy of Family Practice
   Individual physicians representing a variety of related specialties such as Anesthesiology

5. STATE MEDICAL SOCIETY

   Representatives from the Maternal Welfare Committee and the Perinatal Welfare Committee

6. HOSPITAL ASSOCIATIONS

   Massachusetts Hospital Association
   West Suburban Hospital Association
   South Middlesex Hospital Association

7. CONSUMER REPRESENTATIVES

8. BLUE CROSS OF MASSACHUSETTS, INC.

9. COMPREHENSIVE HEALTH PLANNING AGENCIES

   Western Massachusetts Health Planning Council
   Central Massachusetts Health Planning Council
   Merrimac Valley Health Planning Council
   Health Planning Council for Greater Boston
   Health Planning Council of Southeastern Massachusetts
   North Shore Health Planning Council

10. MASSACHUSETTS LEAGUE OF NEIGHBORHOOD HEALTH CENTERS

11. INDIVIDUAL PRACTICING PHYSICIANS

    From maternity and newborn services located in research, teaching, community, urban, suburban and rural hospitals (large and small) and from a number of different geographic areas of the State.

12. REPRESENTATIVES OF THE NURSING PROFESSION IN OBSTETRICS AND PEDIATRICS

13. PSRO MEMBERS

14. INDIVIDUAL HOSPITALS AND INSTITUTIONS

15. UNITED COMMUNITY PLANNING CORPORATION - UNITED WAY

16. TRI-STATE REGIONAL MEDICAL PROGRAM

CHAPTER II

CONSULTATION VISITS AND EDUCATIONAL PROGRAMS

SECTION A - MULTIDISCIPLINARY TEAM CONSULTATION VISITS

A major activity of the Maternity and Newborn Project was to organize multidisciplinary, perinatal, team consultation visits to every maternity and newborn unit in the State.* The major purpose of the consultation visits was to initiate active communication and consultation between high-risk centers and community units. The visits also provided an opportunity to explore new advances in maternity and neonatal care and to discuss current problems and concerns.

The consultant teams were composed of physicians from high-risk maternity and neonatal services. The team included an obstetrician, a pediatrician, an anesthesiologist and a perinatal nurse. The perinatal nurses were employed by the Project and were responsible for coordinating the visits. The multidisciplinary team was utilized in order to emphasize the importance of the concept of perinatal care rather than segmented care by individual disciplines.

In order to explain the scope and objectives of the Project, a basic letter of introduction was sent to each administrator, who was then personally contacted by the Project Director. This follow-up call served to clarify the goals of the Project and the consultation visits. At this time, arrangements were made for the consultant team to meet with the administrator, the chiefs of obstetrics, pediatrics and anesthesiology and director of nursing. Every hospital contacted agreed to participate, and 67 consultation visits were completed over a 12-month period. Following the visits, the consultants prepared a confidential, composite summary of their findings and recommendations which was sent to the hospital.

The consultant teams that visited community hospitals in Regions I and II were selected from the high-risk centers within these regions. Consultant teams for the remaining six regions (eastern Massachusetts) were composed of physicians from the two high risk maternity and newborn centers as well as the independent neonatal intensive care units in Boston. An attempt was made to develop one team for each region. These teams were frequently composed of physicians from more than one institution, thus encouraging communication among the high-risk centers within Boston.

Exchange consultant visits between perinatal centers and independent neonatal intensive care units were arranged during the 2nd year of the Project. Teams were selected from the original consultants with teams from the Boston units visiting in Regions I and II and the teams from Regions I and II visiting the Boston units.

A basic format was developed to assist in providing uniformity to the visits. The entire group, hospital representatives and the consultant team, met at the beginning of each visit. The scope and objectives of the Project were explained

*Martha's Vineyard and Nantucket Hospitals were not included because consultation visits had recently been conducted by the State Health Department.

and questions answered. The document "Towards Improving the Outcome of Pregnancy" was discussed and the concept of regionalization was explored. It was explained that the major objective of regionalization was to promote the best quality of care for every patient within a medically and economically viable system.

Two-way communication among community units, as well as between community units and high-risk centers, was emphasized. The development of a consultant and referral system involving a mutual understanding of the strengths and weaknesses of both the community units and the high-risk centers was also stressed. In addition, on-going education programs were discussed as an integral part of the development of a regional perinatal system.

Following this discussion, the group separated by discipline. Basic worksheets were developed by each discipline. These served as guidelines for the visit and also provided uniformity to the visits.

The team consultation visits identified several common problems and areas of concern. These included the low referral rate of high-risk mothers prior to delivery, the lack of written protocols for the identification and management of high-risk mothers, and the lack of trained personnel for the resuscitation and stabilization of the sick newborn. Other problem areas involved the need to develop a team approach to perinatal care with emphasis on involving the anesthesia staff; to establish perinatal committees; and to develop comprehensive, multidisciplinary, continuing education programs. Problems involving communications and follow-up between high-risk centers and community hospitals were also identified.

Through this consultation program, the Project was able to reach the physicians, nurses and administrators of every hospital with a maternity and newborn service in Massachusetts. Several important objectives were realized:

1. Contact and communication channels were established between high-risk centers and every maternity-newborn service in the State.

2. Community units were encouraged to continue working relationships with at least one high-risk maternity and newborn center of their choice in order to develop on-going programs of consultation, education, referral and evaluation.

3. High-risk centers were encouraged to continue working relationships with community units and to assume responsibility for cooperative development of on-going programs for consultation, education, transfer and evaluation.

4. High-risk centers were also encouraged to communicate and work together more effectively in order to promote better planning and development of regional perinatal systems in Massachusetts and neighboring states.

5. The importance of consultation and referral systems for high-risk mothers prior to delivery and high-risk newborns was emphasized at each visit. Each community unit was encouraged to develop guidelines for the early identification and management of high-risk mothers and newborns.

6. There was open exchange of information and discussion on recent advances and current practices in maternal and newborn care. The consultants, in many instances, provided immediate advice on identified problems and explored areas of particular concern.

7. The consultation visits established a model for peer review and on-going evaluation and monitoring of perinatal services on a regional basis.

SECTION B - CARE CAPABILITY DATA

This section presents a summary of the data collected from the consultation visits and the pre-survey documents completed prior to the visits. Since data collection was not the primary purpose of the consultation visits, the data and analyses are not complete. Nevertheless, they provide valuable information on maternity and newborn resources, practices, and services available in Massachusetts in 1974. This information has been useful in identifying the strengths and weaknesses in perinatal services within the State and in planning for the development of future programs.

The data were analyzed by five categories of maternity service size (live births per year): 0-500, 501-1000, 1001-1500, more than 1501, and units providing high-risk maternity and newborn care. It must be remembered that every hospital did not answer every question; statistical information was not always provided as requested; and consultant worksheets were incomplete because they were used primarily as guidelines, not as detailed survey documents.

1. Assessment of Prenatal Care.

Since the primary focus of the consultation visits was on hospital based care, only three areas were examined in relation to prenatal care.

(a) Availability of parent education courses. The Project found that 86% of the units delivering more than 500 infants per year and 64% of the units delivering less than 500 infants per year provided some type of prenatal education program. The content, length and quality of teaching personnel varied extensively.

(b) Referral of high-risk mothers prior to delivery. Eighteen out of 37 community units reported that they referred one or more maternity patients to high-risk maternity units. Twenty-three direct hospital-hospital referrals were reported to high-risk maternity units. At the present time, there is no accurate measure of the number of high-risk maternity patients in the State nor of the number of referrals directly from physician to physician.

(c) Availability of prenatal records. Information on availability of prenatal records was obtained from 62 hospitals. All but two hospitals reported that prenatal records were routinely available prior to delivery. Records are generally sent to the hospitals between 36-38 weeks by the private physicians. A few hospitals reported detailed systems for obtaining records at the onset of labor. Completeness of these records varied greatly from physician to physician.

Between 60-70% of the units visited reported they had developed some system for identification of high-risk mothers. These systems varied from hospital to hospital and even within hospitals.

2. Intrapartum Care.

The assessment of intrapartum care included obstetrical, nursing and anesthesia care as well as equipment and facilities.

(a) Obstetrical care. According to 50 responding community units, 77% of the deliveries were attended by a Board eligible or certified obstetrician. (Data were not available from maternity services with intensive care units.) Table II-1 shows the breakdown by hospital size category.

TABLE II - 1

PERCENT OF DELIVERIES ATTENDED BY A BOARD ELIGIBLE OR CERTIFIED OBSTETRICIAN IN FIFTY COMMUNITY MATERNITY UNITS BY SIZE CATEGORY, FISCAL YEAR 1974

Maternity Unit Size[1]	Percent of Deliveries Attended by Board Eligible or Certified Obstetrician[2]
≤500 (14/15)	74% (3,820/5,179)
501-1000 (21/24)	81% (12,674/15,737)
1001-1500 (10/13)	81% (9,860/12,152)
> 1500 (5/7)	73% (7,278/9,922)

Source: Massachusetts Maternity & Newborn Project Presurvey Document

[1]Number of hospitals in size category responding in parenthesis

[2]Number of deliveries attended by Board eligible or certified obstetrician in parenthesis

(b) Nursing observation during labor and delivery. All of the hospitals indicated that the nurse had primary responsibility for obtaining labor observations on both mother and fetus and reporting any abnormalities to the physician in charge. The frequency of obtaining and recording observations varied according to hospital procedure. Eighty percent of the hospitals reported obtaining nursing observations every 15 minutes or less during active labor and 64% reported obtaining nursing observations every 30 minutes or less during early labor.

(c) Electronic fetal monitoring. External electronic fetal heart rate monitoring has become a recognized part of intrapartum care, especially for high-risk mothers and mothers undergoing induction of labor. When correctly used by skilled personnel, it provides an accurate, constant measure of the fetal heart rate and its variations before, during and after contractions.[19] External fetal monitors were available in 100% (25/25) hospitals delivering over 1000 infants per year, in 92% (22/24) of the hospitals delivering between 500 and 1000 infants per year, but in only 53% (8/15) of the hospitals delivering less than 500 infants per year. In most cases, in-service education was provided by the manufacturing company at the time the equipment was purchased. The degree of follow-up in-service education for monitoring was not clear. The majority of the units have not as yet established written policies and procedures regarding the use of fetal monitors.

(d) Notification of pediatrician to be present at delivery. Information was collected on whether units notify a pediatrician of an anticipated problem (such as C-section, premature delivery, high-risk mother) or an immediate problem (such as fetal distress or difficult delivery) and request a pediatrician to be present at the time of delivery. Between 57% and 67% of all size categories requested a pediatrician to be present at Cesarean sections. Units were less likely to request a pediatrician for other high-risk conditions such as fetal distress, difficult delivery, premature delivery and high-risk mother.

(e) Location of recovery area. The American College of Obstetricians and Gynecologists and the Committee on Perinatal Health recommend that a separate recovery area with emergency equipment be available in each delivery suite.[11,21] A separate recovery area also allows for more infant-mother-father interaction during this early period. Consultant visits found that the "recovery area" varied greatly from unit to unit. Separately designated recovery rooms were available more frequently as the size of the service increased. Table II-3 shows the variation in location of recovery areas.

TABLE II-3

PERCENT OF MATERNITY SERVICES UTILIZING SPECIFIC AREAS FOR MATERNAL RECOVERY FOLLOWING DELIVERY[1]

Size Category	Separate Recovery Area	Labor Room	Delivery Room	Other[2]
≤500	7% (1/14)	21% (3/14)	50% (7/14)	21% (3/14)
501-1000	9% (2/23)	35% (8/23)	35% (8/23)	21% (5/24)
1001-1500	64% (7/11)	9% (1/11)	18% (2/11)	9% (1/11)
>1500	57% (4/7)	14% (1/7)	14% (1/7)	14% (1/7)
High Risk Center	100% (5/5)			

Source: Massachusetts Maternity and Newborn Project Survey Worksheets

[1]Number of hospitals is in parenthesis

[2]Other - Hall or Patient Rooms

3. Cesarean Sections.

Facilities to perform Cesarean sections should be located within the delivery suite.[11] According to data from the consultant visits, only 59% of the maternity units in Massachusetts meet this criteria. Table II-4 presents the data and indicates an inverse relationship between size of maternity unit and dependency on the general surgical operating suite, i.e., the smaller the maternity unit, the greater the dependency on the hospital surgical operating suite and their team. This dependency can lead to delays in the performance of a Cesarean section until an operating room is free or cleaned. Therefore, it is recommended that each maternity service be equipped to perform at least emergency Cesarean sections within the delivery suite.

TABLE II - 4

DISTRIBUTION OF HOSPITALS[1] BY UTILIZATION FREQUENCY OF DELIVERY SUITE OR SURGICAL OPERATING ROOM FOR CESAREAN SECTION BY MATERNITY UNIT SIZE, MASSACHUSETTS, 1974

Maternity Unit Size	Delivery Suite Use In % Responding	Surgical Operating Room In % Responding	% & Total Hospitals Responding
≤500	47% (7)	53% (8)	100% (15)
501-1000	50% (11)	50% (11)	92% (22)
1001-1500	62% (8)	38% (5)	100% (13)
>1500	83% (5)	17% (1)	86% (6)
Maternity Units with NICU	100% (5)	-- --	100% (5)
Total	59% (36)	41% (25)	95% (61)

Source: Massachusetts Maternity and Newborn Project Consultant Worksheets

[1]Number of hospitals responding in each category is shown in parenthesis.

An important measure of the efficiency of a delivery service is the time required to prepare for an emergency Cesarean section. Despite some variation in data reported by obstetricians, anesthesiologists and nurses, the following conclusions can be drawn: (a) over 50% of all hospitals are capable of performing an emergency Cesarean section within 20 minutes during the day; (b) at night over 50% of the hospitals delivering less than 1000 infants per year require longer than 20 minutes to prepare for a Cesarean section.

4. Anesthesia.

(a) Personnel administering anesthesia. Information from 56 community hospitals indicated that 220 physician anesthesiologists, 26 obstetricians, 13 physician generalists, 136 nurse anesthetists, 12 anesthesia residents and 2 obstetrical residents were involved in administering anesthesia to obstetrical patients in 1974.

(b) Availability of physician anesthesiologists. Physician anesthesiologists were available in-house 24 hours a day in 80% (4/5) of the units with neonatal intensive care units; in 60% (12/20) of the units with over 1000 deliveries per year; and in only 23% (9/39) of the units under 1000 deliveries per year.

(c) Anesthesia techniques. All the hospitals responding (55/64) indicated that endotracheal intubation was required when general anesthesia was administered for Cesarean section. However, the use of endotracheal intubation when general anesthesia was administered during a vaginal delivery varied from hospital to hospital and even within hospitals depending on the anesthetic agent utilized.

The regional anesthesia of choice in community units was spinal anesthesia. Twenty-seven out of 47 units reported the use of spinal anesthesia 71-99% of the time for vaginal deliveries, and 33 out of 50 units reported the use of spinal anesthesia over 50% of the time for Cesarean sections.

5. Newborn Care.

(a) Care of the high-risk newborn. Twenty-two percent of the 59 community units visited reported having specially designated areas (Special Care Nurseries or Premature Nurseries) for the care of high-risk newborns.

(b) Availability of equipment. The ability of newborn units to manage neonatal problems varied considerably depending on the skills of the pediatricians and the nursing staff as well as the availability of equipment. Hospitals with over 1000 deliveries per year were more likely to have specialized equipment for the treatment of newborn problems (Table II-9).

TABLE II-9

DISTRIBUTION OF EQUIPMENT AVAILABLE IN HOSPITALS BY MATERNITY UNIT SIZE, MASSACHUSETTS, 1974

Maternity Unit Size	Percent of Hospitals with Equipment Available[1]					Total Hospitals Responding
	Cardiac Monitor	Respiratory Monitor	Radiant Heaters	Oxygen Monitor	IV Pump	
≤500	7% (1)	13% (2)	47% (7)	13% (2)	33% (5)	15
501-1000	42% (10)	42% (10)	63% (15)	50% (12)	17% (4)	24
1001-1500	85% (11)	85% (11)	77% (10)	62% (8)	92% (12)	13
>1500	71% (5)	86% (6)	86% (6)	71% (5)	86% (6)	7

Source: Massachusetts Maternity and Newborn Project

[1]Number of hospitals in each category is shown in parenthesis.

(c) Neonatal transfers. According to consultant visit data the neonatal transfer rate in Massachusetts for 1974-1975 was 1.35% with variations among hospitals ranging from 0.15% to 4.6%. Table II-10 summarizes the number and percent of transfers by size category for 59 community units. These data vary somewhat from the data collected on the Annual Hospital Statistical Report by the Massachusetts Department of Public Health (Chapter V-B).

TABLE II-10

DISTRIBUTION OF NEWBORN TRANSFERS TO NEONATAL INTENSIVE CARE UNITS BY MATERNITY UNIT SIZE TRANSFERRING, MASSACHUSETTS, 1974

Maternity Unit Size	Number of Live Births	Number of Transferred Newborns	Percent of Newborns Transferred
≤500	5,643	81	1.44
501-1000	16,022	229	1.43
1001-1500	16,133	190	1.17
>1500	13,014	208	1.59
Total	52,484	708	1.35

Source: Massachusetts Maternity and Newborn Project Presurvey Document

Table II-11 summarizes the breakdown of 460 neonatal transfers by gestational age and reason for transfer. There were 30 transfers of infants under 1000 grams, but it was not possible to break down this group into gestational age.

TABLE II-11

DISTRIBUTION OF NEWBORN TRANSFERS BY REASON FOR TRANSFER AND GESTATIONAL AGE, MASSACHUSETTS, 1974

Reason For Transfer	Gestational Age[1] 28-36 weeks (196 infants)	37-39 weeks (128 infants)	40 weeks and over (136 infants)
Respiratory Distress Syndrome, Pneumonia, Atelectasis	67% (132)	24% (31)	20% (27)
Congenital Anomalies	12% (24)	39% (50)	33% (45)
Prematurity	11% (21)	1% (2)	--
Hemolytic Disease	1% (2)	8% (10)	9% (12)
Metabolic Disorders	1% (2)	1% (2)	3% (4)
Meconium Aspiration	--	--	9% (12)
Sepsis	2% (3)	9% (11)	9% (12)
CNS Disorders, Anoxia, Seizures, Apnea	4% (7)	9% (11)	9% (13)
Other	2% (5)	9% (11)	8% (11)
Total	100% (196)	100% (128)	100% (136)

Source: Massachusetts Maternity and Newborn Project Presurvey Document

[1] Number of newborn transfers for each reason listed is in parenthesis

Thirty-eight out of 47 community maternity-newborn units reported receiving at least one infant referral back from an NICU within the past year. The larger services more frequently reported referrals back. Twenty-one out of 47 units receiving recovery infant referrals reported that these infants were admitted to the normal nursery, or if available, the Special Care-Premature area.

(d) Neonatal mortality. There were 392 neonatal deaths reported on the pre-survey documents from 59 maternity and newborn units. This does not include neonatal deaths in high-risk, perinatal centers. Table II-14 summarizes 258 of the reported deaths by "cause of death." In most instances, only the immediate cause of death was listed. Autopsy information was available in only a few cases.

TABLE II - 14

CLASSIFICATION OF 258 COMMUNITY NEONATAL DEATHS BY CAUSE OF DEATH FOR FISCAL YEAR, 1974

Cause of Death	Number of Deaths In This Category	Percent
Immaturity, under 28 weeks	44	17%
Prematurity, unqualified (28-36+ weeks)	44	17%
Neonatal and fetal asphixia and Anoxia	14	5.4%
Congenital Anomalies	76	29%
Respiratory Distress Syndrome (includes HMD, Atelectasis, Meconium Aspiration)	53	21%
Sepsis	5	1.9%
Cerebral and intraventricular Hemorrhage	3	1.2%
Deaths related to Placental Insufficiency, prolapsed cord, breech delivery and other complications of delivery	8	3.1%
Other or Unknown	11	4.3%

Source: Massachusetts Maternity and Newborn Project Presurvey Document

(e) General newborn care. According to pre-survey document information, 100% of the infants in neonatal intensive care units were seen at least once by a pediatrician. Eighty-two percent of the infants born in 44 community maternity units were cared for by a Board-eligible or certified pediatrician. Approximately 6,602 newborns (18%) were cared for by a family practitioner, general practitioner or the obstetrician. All units reported obtaining one and five minute Apgar scores, although the person responsible for obtaining the score varied greatly. All hospitals reported that an admission physical was required within 24 hours after birth or sooner; however, it was difficult to determine whether this policy was followed.

6. Family-Centered and Innovative Approaches to Maternity Care.

Over the past 10 years, considerable emphasis has been placed on family-centered maternity care. All of the maternity high-risk centers and units delivering over 1500 births per year indicated they had a family-centered approach to post-partum care. Sixty-one percent of the hospitals delivering under 1500 infants per year reported a family-centered program. However, clarification of what "family-centered" means is needed.

7. Laboratory Services.

The availability of blood bank, radiology and laboratory services is important for the provision of high quality maternity and newborn care. Consultants did not attempt to evaluate the quality of these services but only to determine the availability of technicians to perform selected tests and procedures (Table II-17).

TABLE II-17

AVAILABILITY OF IN HOUSE RADIOLOGY, BLOOD BANK AND LABORATORY TECHNICIANS[1]
BY MATERNITY UNIT SIZE, MASSACHUSETTS, 1974

Maternity Unit Size	Radiology Technician Available In Hours				Blood Bank Technician Available In Hours				Laboratory Technician Available in Hours			
	8	12-16	24	Number of Hospitals Responding	8	12-16	24	Number of Hospitals Responding	8	12-16	24	Number of Hospitals Responding
≤500	43% (6)	43% (6)	14% (2)	(14)	20% (3)	53% (8)	27% (4)	(15)	13% (2)	53% (8)	33% (5)	(15)
501-1000	26% (6)	39% (9)	35% (8)	(23)	4% (1)	22% (5)	74% (17)	(23)	4% (1)	22% (5)	74% (17)	(23)
1001-1500	42% (5)	25% (3)	33% (4)	(12)	8% (1)	8% (1)	83% (10)	(12)		17% (2)	83% (10)	(12)
>1500	29% (2)	29% (2)	43% (3)	(7)	- -	43% (3)	57% (4)	(7)		43% (3)	57% (4)	(7)
Maternity High Risk Center	40% (2)		60% (3)	(5)		20% (1)	80% (4)	(5)			100% (5)	(5)

Source: Massachusetts Maternity and Newborn Project Presurvey Document

[1]Number of Hospitals in each size category is shown in parenthesis

8. Administrative Committees.

Fifty-eight of the 64 hospitals surveyed indicated that they had a formal nursery committee which met regularly. Most of the units stated that a "perinatal" committee incorporating all aspects of maternity and newborn care would be more beneficial - especially for the smaller units. Only 41% (26/64) of the services indicated they had a formal perinatal mortality committee and most of these committees were limited to obstetricians and pediatricians.

SECTION C - REGIONAL EDUCATIONAL PROGRAMS

Another major activity of the Project has been the development of educational programs for health professionals and consumers to explain the concepts of regionalization of perinatal care and to promote the development of regional perinatal systems.

Regional Educational Programs for health professionals, lay decision makers and the general public were held during the first year of the Project. The purpose of these programs was to explore the concepts of regionalization and to stimulate community involvement in the development of regional perinatal systems. These programs were planned in conjunction with the Comprehensive Health Planning Agencies, the regional high-risk centers, physician and nurse consultants, and other interested groups in the region. A special effort was made to clarify the issues for important decision makers such as hospital trustees and members of comprehensive health planning boards.

The most successful format for these programs focused on four key areas: (1) an explanation of what regionalization means and why it is widely endorsed; (2) a discussion of recent advances in perinatal care and how regionalization can help to improve the quality and range of services available; (3) a presentation on the general findings and recommendations of the consultant teams that visited each region; and (4) a discussion of the planning, utilization and economic issues related to regionalization. Speakers were selected from the health planning agencies, Project staff, Project consultants and other physicians who indicated an interest. The presentations were followed by a question and answer period.

A major goal of the second year of the Project was to organize educational programs for physicians and nurses addressing some of the needs and problems identified. To assess the educational needs as well as preferences for program location and format, a survey questionnaire was developed and sent to the chiefs of anesthesia, obstetrics and pediatrics, the director of nursing and the administrator of all hospitals with maternity and newborn services. Information received served as a framework for the program design.

In view of the success of the regional educational programs developed by Region I and Region II, a decision was made to augment their education programs rather than initiate new programs. In Region I, the Project assisted the Wesson Women's Division of the Bay State Medical Center in supporting two educational programs. The first program focused on fetal monitoring and consisted of a two-day nursing workshop. The course provided in-depth theoretical background and clinical experience in fetal-maternal, electronic monitoring during the antepartum and intrapartum periods. The second program, "Follow-up Care for the High-Risk Newborn," was a one-day workshop for physicians, nurses, social workers, psychologists, students and other interested persons.

The program in Region II was developed in conjunction with the high-risk center at the Worcester Memorial Hospital. It was entitled, "Current Trends in High-Risk Maternal and Newborn Care," and consisted of a one-day, nurse-physician workshop which dealt with the identification and management of maternal and neonatal problems.

For the remaining six regions, a three-part program was developed and presented in three different locations in eastern Massachusetts. Session A focused on prenatal care, Session B focused on intrapartum care, and Session C focused on neonatal and family care. Program locations were chosen to serve specific regions but participants were encouraged to cross-register, if necessary, to enable them to attend all three sessions.

Teaching personnel were chosen primarily from perinatal and neonatal centers serving Massachusetts in order to: (1) utilize physicians and nurses with current clinical as well as theoretical expertise; (2) foster good relationships between high-risk centers and community units; (3) acquaint high-risk center staff with the needs of the community hospitals; (4) familiarize the community hospital staff with personnel from and the capabilities of the high-risk centers; and (5) encourage the high-risk centers to assume responsibility for the development of regional educational programs.

Continuing education credits for both nurses and physicians were obtained from the American Medical Association, the American College of Obstetricians and Gynecologists and the Massachusetts Nurses Association.

Attendance at all sessions far exceeded original expectations. Session A drew approximately 600 people; Session B, 500 and Session C, 400. A total of 552 registered nurses, 89 physicians and 50 others attended one or more sessions.

The lecturers demonstrated great flexibility in adjusting to the needs and the levels of different group compositions. Evaluation forms completed by those attending revealed that almost without exception the participants felt that the programs had met their needs and expectations and that they would attend future programs. A variety of topics were cited as particularly helpful such as: identification of high-risk patients, all aspects of fetal monitoring, the use of anesthesia, resuscitation techniques, the psycho-social aspects of maternity-newborn care, treatment of the obstetrical and neonatal emergency, and the stabilization and transfer of the newborn. It was felt that future programs should provide greater emphasis on the nursing role and the psycho-social aspects of perinatal care.

Recommendations - Chapter II

Section A - Multidisciplinary Team Consultation Visits

1. Perinatal centers, neonatal intensive care units and community hospitals should continue to expand the contacts and communication channels that have been established.

2. Each regional system should develop a mechanism for conducting annual consultation and evaluation visits including assessment of care capability.

3. A statewide multidisciplinary program should be developed to coordinate regional programs. This would include: standard settings, criteria for evaluating regional programs, and mechanisms for monitoring mortality and morbidity.

Section B - Care Capability

1. Aggregate data from the 1974 care capability survey should be used by perinatal centers and community hospitals to evaluate services, identify problems, and initiate improvements in perinatal services.

2. There should be an on-going, statewide mechanism for determining high-risk prenatal referrals between physicians and hospitals.

3. All units should have a multidisciplinary perinatal committee to develop and update perinatal policies and procedures and to review perinatal mortality and morbidity.

4. Uniform prenatal, labor, delivery, newborn and postpartum charts and records should be developed for use by all perinatal units.

5. Standards, guidelines and educational programs on the use and interpretation of fetal electronic monitoring should be developed in each maternity unit as well as on a regional and statewide basis.

6. Cesarean sections should be performed within the delivery suite. At the minimum, each delivery suite should be properly equipped and prepared to perform emergency Cesarean sections.

7. Every maternity and newborn service should have a recovery room area with emergency equipment readily available.

8. Each maternity and newborn unit should periodically evaluate its care capabilities in relation to the accepted professional standards of the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, the American Society of Anesthesiologists, American Nurses Association, and Nurses Association of the American College of Obstetricians and Gynecologists.

9. Intensive perinatal care units and community units should work together to improve care capabilities and regional perinatal services in each region.

Section C - Regional Educational Programs

1. Regional educational programs should be planned on a regular basis as a cooperative effort between high-risk centers and community hospitals.

2. A variety of educational programs should be planned including one-day workshops, series of seminars, and clinical experience sessions.

3. The overall responsibility for coordinating the educational programs within a designated area or with designated hospitals should be assumed by the perinatal centers servicing those units.

4. Community hospitals within a geographic area and/or having similar needs should begin to coordinate their in-service maternity and newborn staff education programs.

5. The Perinatal Welfare Committee of the Massachusetts Medical Society should act as a multidisciplinary central clearing house for maternity and newborn educational programs. Information should be collected on all programs (center and community) and should be made available to all perinatal units on a regular basis.

6. The Massachusetts Department of Public Health should assist in the development of regular regional perinatal educational programs through the Department's regional perinatal care program.

CHAPTER III

REVISED STANDARDS AND REGULATIONS

Another activity of the Project has been the development of revised standards and regulations for maternity and newborn services in Massachusetts. In recent years various professional groups have developed excellent clinical standards and guidelines for maternity and newborn care. These include revised editions of "Hospital Care of Newborn Infants,"[20] from the American Academy of Pediatrics, "Standards for Obstetric-Gynecologic Services,"[21] from the American College of Obstetricians and Gynecologists, and "Toward Improving the Outcome of Pregnancy: Recommendations for the Regional Development of Perinatal Health Services,"[11,12] by the Committee on Perinatal Health. The latter specifies standards for facilities, services and personnel for each level of care - Level I (uncomplicated); Level II (intermediate) and Level III (perinatal center).

Completely revised regulations for hospital newborn and obstetric services were adopted by the Massachusetts Department of Public Health in 1970 and 1971.[14,15] These were highly effective in upgrading the overall quality of maternity and newborn services in the State. The regulations laid the foundation for the establishment of different levels of care, encouraged the identification and transfer of high-risk newborns and stimulated the development of regional newborn programs.

The authority and leadership of the Department of Public Health in developing and enforcing high standards of care have been key factors in improving the quality, organization and delivery of maternity and newborn services in Massachusetts. However, the present regulations are out of date. Revision of these regulations, supported by the authority and leadership of the Department, could have a major impact on the quality of perinatal care and the regional development of perinatal services.

Therefore, the Maternity and Newborn Project organized two broadly representative, statewide, multidisciplinary task forces to review present regulations and relevant professional standards, and to recommend revisions in standards and regulations for maternity and newborn services in Massachusetts. The following standards and guidelines were developed:

1. Proposed amendments to hospital regulations for maternity and newborn services.

The proposed amendments to the licensure regulations represent changes that are considered critical for improving perinatal care in Massachusetts. They include: definition and official designation of perinatal centers; institutional agreements between perinatal centers and community hospitals; policies and procedures for the identification and management of high-risk maternity and newborn patients; hospital perinatal policy and review committees; policies for the readmission of transferred infants to the hospital of birth; improved anesthesia services; and changes in visiting policies.

The revised regulations would have minimal cost implications, but would greatly enhance the quality and organization of perinatal care in Massachusetts. The recommended revisions have been transmitted to the State Health Department for consideration and adoption.

Separation of obstetric and newborn care is detrimental to the quality and continuity of care - especially for high-risk patients. Official designation of high-risk special care and transfer nurseries is already required by the Health Department.[15] The proposed regulations would complement existing regulations by requiring official designation of high-risk obstetric units as well. Units that provide both high-risk obstetric and newborn services would be officially designated as Perinatal Centers, i.e., centers which provide a full spectrum of high-risk maternal, fetal and newborn care.

Institutional agreements between perinatal centers and community hospitals would help to promote cooperative working relationships, consultation, and transfer of high-risk patients when indicated. The proposed regulations allow complete flexibility for centers and community hospitals to work out the nature and extent of these agreements in accordance with their capabilities and needs.

Policies and procedures for the identification and management of high-risk newborns are presently required.[15] The proposed regulations would extend this to include high-risk obstetric patients - especially obstetric patients whose newborns have a high probability of requiring intensive care.

Hospital perinatal mortality committees have been recommended by ACOG and AAP for many years as a means to upgrade the quality of maternity and newborn care.[21,22,23] The proposed regulations would require every hospital with a maternity and newborn service to establish a multidisciplinary committee for setting policies and for reviewing maternal, fetal and newborn mortality and morbidity. The proposed regulations also include basic anesthesia requirements which assure the same quality of anesthesia services as are available to surgical patients.

The Project's task forces also worked on a complete revision of present licensure regulations for maternity and newborn services in hospitals. These revisions were not completed, but the basic materials were used to prepare Guidelines for Levels of Perinatal Care in Massachusetts.

2. Recommended classification of high-risk maternity and newborn patients.

Significant progress has been made in the identification, management and treatment of high-risk mothers and newborns. Rates of maternal, fetal and neonatal mortality and morbidity have been markedly reduced where high-risk patients have been identified early and treated in units able to provide the latest services and expertise in perinatal care. In addition, critically ill newborns treated with the latest techniques, survive with significantly less damage than before.[2,7,11] Therefore, it is essential to develop guidelines for the identification and management of high-risk mothers and newborns and to develop plans for the care and treatment of such patients in units which can provide a level of care appropriate to their needs.[24,25,26]

Certain categories of high-risk obstetric and newborn patients require highly specialized care and should be delivered in a perinatal center. In particular, obstetric patients with conditions that pose a significant risk to the fetus or newborn should be delivered in a perinatal center where intensive newborn care is immediately available and separation of mother and newborn can be minimized.

The task forces of the Maternity and Newborn Project reviewed a number of existing classifications and developed a recommended classification of high-risk maternity and newborn patients, including specific categories of patients that should be treated in high-risk centers whenever possible. The classification includes a definition of high risk, a general classification of high risk conditions, and a list of conditions that usually require intensive care.

The task forces recommended that the classification of high-risk maternity and newborn patients be used by physicians and hospitals in Massachusetts as a guideline for the development of policies and plans for the identification and management of high-risk patients including indications for consultation, referral or transfer to designated high-risk centers when indicated.

3. Criteria for designation of perinatal centers.

Preliminary criteria for the designation of perinatal centers have been developed. These include basic standards for personnel, equipment, facilities, and services that are essential in order to provide high quality, intensive care for high-risk mothers and newborns. The capacity of each maternity and newborn service to care for different types of patients will depend on the range and quality of services, resources and personnel available. Only units that can provide a full range of high quality, specialized maternal, fetal and newborn services should be designated as perinatal centers.

The personnel and services provided in these centers are scarce and expensive. A sufficient volume of patients is necessary to provide these specialized services in an efficient and economical way, to attract trained staff, and to maintain their skills and competence. Therefore, only a limited number of such centers should be established as determined by resources, population, and geographic needs. In turn, perinatal centers must develop close working relationships with community hospitals and physicians in order to make their specialized services available to all patients who need them.

4. Recommended uniform perinatal terminology and recommended revisions of Massachusetts Department of Public Health Statistical Forms.

In the past there have been problems with data reported by hospitals, agencies and organizations because of the different terminology, fiscal years and reporting forms that are used. Therefore, the Project staff has worked with the Statistics and Standards Subcommittee of the Perinatal Welfare Committee of the Massachusetts Medical Society and the Office of Health Statistics and Analysis of the Massachusetts Department of Public Health to promote better reporting and use of perinatal data.

A uniform perinatal terminology, including standard terms and definitions, was developed for statistical gathering purposes. This terminology will be recommended for use by all agencies, institutions and organizations in order to promote more accurate and comparable statistics and information on maternity and newborn services in the State.

Recommended additions and changes to two Department of Public Health data gathering forms, the Annual Hospital Statistical Report and the Live Birth Certificate, were also made.

Recommendations - Chapter III

1. The Massachusetts Department of Public Health should promulgate the proposed amendments to the hospital regulations for maternity and newborn services as quickly as possible. The Department should continue to work with advisory committees to revise completely the present, out-dated maternity and newborn regulations using the Guidelines for Levels of Perinatal Care as a basis for this effort. The Department should use the criteria for perinatal centers as guidelines for the official designation of high-risk centers.

2. The Perinatal and Maternal Welfare Committees of the Massachusetts Medical Society should develop a set of guidelines on regionalization of perinatal care that would be helpful to Massachusetts physicians. This might be similar to the Goals for Regionalized Perinatal Care developed by the California Medical Association.[27]

3. The classification of high-risk maternity and newborn patients should be used as guidelines by hospitals, physicians and other groups to develop adequate policies and procedures for the early identification, management and transfer (when indicated) of high-risk patients.

4. All institutions, agencies and organizations interested in maternity and newborn care should utilize the uniform perinatal terminology that has been developed to promote accurate, uniform and comparable statistics on maternity and newborn mortality and morbidity.

5. The Office of Health Statistics and Analysis of the Massachusetts Department of Public Health should work with the Statistics and Standards Subcommittee of the Massachusetts Medical Society, the Massachusetts Hospital Association, perinatal centers and individual hospitals to develop a uniform reporting form for recording and monitoring perinatal morbidity and mortality.

CHAPTER IV

HEALTH PLANNING AND RESOURCE DEVELOPMENT

A major objective of the Project has been to promote better planning and more efficient utilization of maternity and newborn services. The dramatic decline in births in Massachusetts has caused widespread underutilization and economic hardship for maternity and newborn units. At the same time, there have been increasing demands for health planning agencies, the State Determination of Need Program, third party payers, the Rate Setting Commission and the State legislature to develop more efficient and cost effective ways to organize and deliver health services.

Of particular importance is the recently enacted Health Planning and Resources Development Act of 1974. This Act requires the State Health Planning and Development Agencies and the Regional Health Systems Agencies to develop state medical facilities and health systems plans. These plans must be population based and must assure that all persons have adequate access to quality health services with continuity of care at a reasonable cost. The legislation emphasizes the elimination of unnecessary duplication of health resources, the reduction of documented inefficiencies, and the development of multi-institutional systems for coordination or consolidation of services. The provision of primary care services, especially for medically underserved areas, is also stressed. When fully implemented, this program should have a substantial impact on the planning and development of maternity and newborn services.

The planning issues addressed in this report were identified by the Project staff with the advice and assistance of representatives from the fields of health planning, health administration, public health, health insurance, economics and statistics. The following standards, guidelines and methodologies are recommended for planning and organization of maternity and newborn services in Massachusetts.

SECTION A - TRAVEL TIME

All women and newborns should have reasonable access to prenatal care, perinatal services in community hospitals, and high-risk perinatal and neonatal services. To assure reasonable access, a number of states and health planning agencies throughout the U.S. have developed travel time and travel distance standards for maternity and newborn services.[28,29,30]

In Massachusetts, most communities are within 10 miles of a maternity-newborn service. Approximately 25 of the 351 cities and towns (only 1.1% of the State's population) are not within a ten-mile radius of a maternity service (Figure IV-1). Only six communities (four on the tip of Cape Cod), comprising 0.2% of the population are more than 15 miles from a maternity service.

The high-risk perinatal and neonatal centers that serve Massachusetts are located in Springfield, Worcester, Boston and Providence, Rhode Island. Approximately 23 cities and towns, comprising only 2% of the State's population, are outside a 50 mile radius from a perinatal center. Only three community hospitals with maternity and newborn services (Cape Cod and the Islands) are more than 50 miles from a high-risk center. These three hospitals produced 1.5% of the State's births in F.Y. 1974 (Figure IV-2).

More detailed information on travel time and travel distance to basic perinatal services should be developed by the Health Systems Agencies in each Health Systems Area.[18] This information should include adjustments for traffic congestion, weather and other extenuating conditions.

FIGURE IV-1

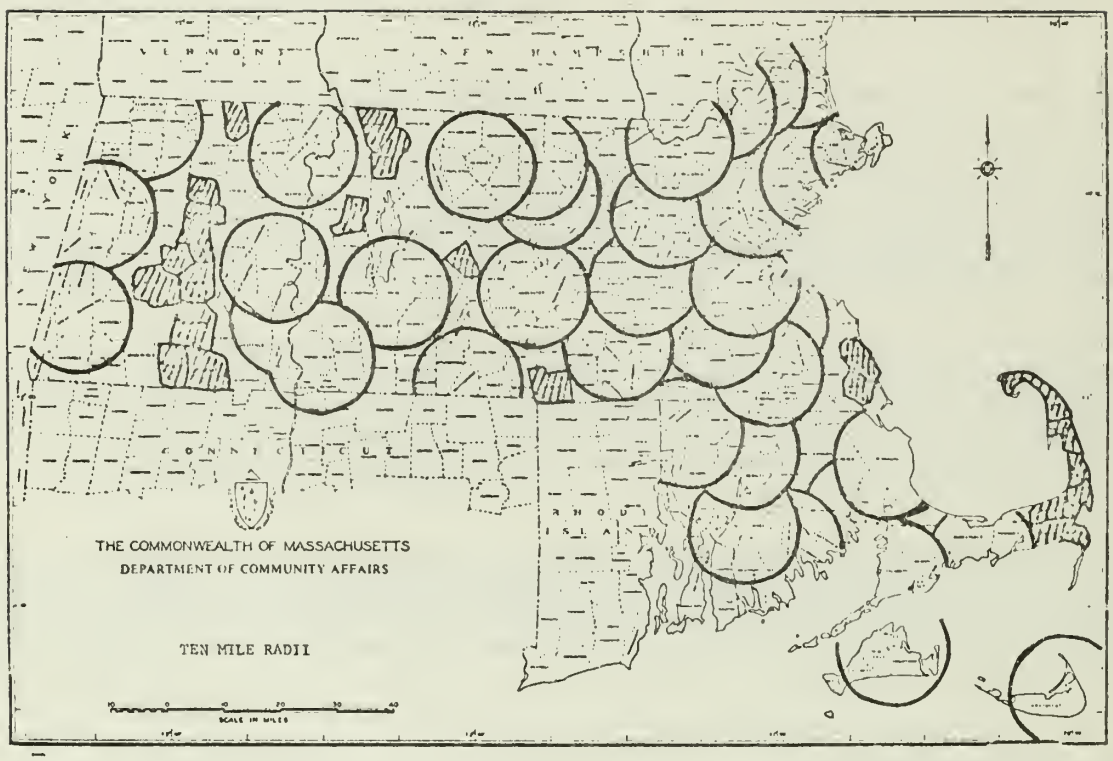
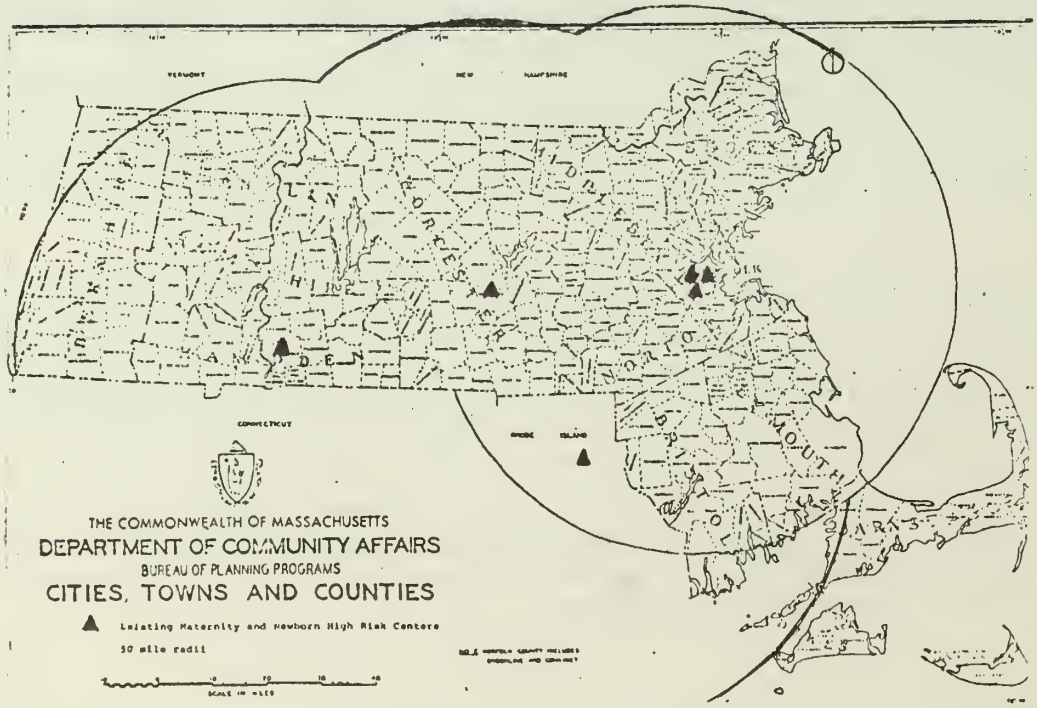


FIGURE IV-2



SECTION B - AVERAGE LENGTH OF STAY (ALS)

The average length of stay is widely used by planners in assessing maternity bed need and projecting future utilization. Health planning agencies throughout the U.S. have adopted ALS standards for maternity services which range between 3.5 and 4.0.[16,17,31,32]

A basic problem with a single ALS standard is that it does not reflect the mixture of diagnostic and therapeutic problems found in maternity services. Various types of admissions (pregnancy related problems, deliveries with complications, deliveries without complications, and abortions) have very different average lengths of stay (Table IV-2)

TABLE IV-2

AVERAGE LENGTH OF STAY, MASSACHUSETTS UIS 1974 FY

US 1972, WEST 1972

ICDA		Mass UIS 1974 FY	U.S. 1972	West 1972	A	B
650	Deliveries Without Complications	3.9	3.8	3.0	3.45	3.22
651-661	Deliveries with Complications	5.38	5.0	4.0	4.69	4.34
630-634	Complications of Pregnancy	2.45	2.6	2.2	2.33	2.26
640-645	Abortions	1.96	2.2	1.6	1.78	1.68
TOTAL		3.88	3.70	2.93	3.4	3.2

In addition, perinatal services in Massachusetts provide different "levels" of care (Chapter III).[11] High-risk perinatal centers caring for a disproportionate number of patients with complicated deliveries, would be expected to have a greater ALS than services providing largely uncomplicated care. Therefore, ALS standards should take into account both the mixture of patients being cared for and the level of care provided by the maternity service.

The first step in projecting an ALS for a maternity service should be an examination of the hospital's current discharges and discharge days for the four basic ICDA categories: Deliveries without Complications, Deliveries with Complications, Complications of Pregnancy, and Abortions (induced and spontaneous). Changes in projected patient mix should be justified. Then the mix should be applied to the projected ALS for each of the ICDA categories to obtain an adjusted ALS which can be used for utilization projections.

The ALS for maternity patients in the U.S. decreased dramatically from 9 days in the mid-1960's to 3.7 days in 1972, and further reductions are expected. In addition, there are marked variations among regions of the U.S. For example, the ALS for maternity admissions in the West in 1972 was 25% less than in Massachusetts in 1974 (Table IV-2).

Suggested ALS standards for each of the four ICDA categories can be seen in Columns A and B in Table IV-2. Column A assumes that the percentage difference between the 1974 Massachusetts figures and the 1972 West figures will be reduced by 50%; Column B assumes a reduction in the difference by 75%. The Project recommends using the ALS standards under Column B which would result in a 15.5% overall reduction in the ALS for Massachusetts from 3.9 to 3.2.

SECTION C - SIZE OF MATERNITY SERVICE

In planning for perinatal services, it is important to develop standards for the optimal size of these services. Size standards are needed to promote high quality of care, more efficient utilization of costly manpower and resources, and better geographic distribution of services. Size standards are an essential part of the planning for maternity services as mandated by the Health Planning and Resources Development Act of 1974. These standards should be used by the Health Systems Agencies in developing and implementing plans for the number and types of maternity units in each part of the State and by the Massachusetts Department of Public Health in the Determination of Need Program.

1. Trends in the number and size of maternity units in Massachusetts.

Over recent years, there have been substantial changes in the number and size of maternity units in Massachusetts. The total number of units has declined from 120 in 1960 to 61 in 1976. Table IV-7 shows the number of maternity units by size category in 1971 and 1975.* In addition to closure or consolidation, many larger units have shifted to a smaller size due to the rapidly declining number of births. In 1975, 22% of the maternity services were less than or equal to 500 births per year, 57% were less than or equal to 1000 births per year and only 22% were greater than 1500 births per year.

TABLE IV-7

MATERNITY UNITS IN MASSACHUSETTS IN 1971 AND 1975

BY SIZE, NUMBER OF MATERNITY BEDS AND OCCUPANCY RATES

Size by No. Deliveries	Maternity Units				Maternity Beds				Occupancy Rates	
	1971		1975		1971		1975		1971	1975
	No.	%	No.	%	No.	%	No.	%	%	%
0-500	19	23.8	14	22.2	228	11.5	142	9.7	39.8	40.8
501-1000	27	33.8	22	34.9	508	25.6	422	29.0	57.0	57.7
1001-1500	15	18.8	13	20.6	405	20.4	370	25.4	60.7	61.4
1501-2000	12	15.0	9	14.3	351	17.7	268	18.4	70.6	68.1
>2000	7	8.8	5	7.9	492	24.8	354	17.4	74.3	71.4
TOTAL	80	100%	63	100%	1984	100%	1556	100%	62.5%	62.0%

Source: Blue Cross of Massachusetts

*Units phased out during this year are not included

Table IV-4 shows the number of live births and the percent of total State live births by maternity service size from 1969 to 1974. The total number of live births in Massachusetts hospitals decreased by 25% from 1969 to 1974. The most significant decreases in numbers of live births occurred in the size categories 1001-1500 (-41%) and >2000 (-33%). Over this six-year period, units with >2000 births per year continued to account for approximately 25% of the State's live births. The size category 1001-1500 showed a substantial decrease from 26.3% to 20.8% (-21%) of the State's total live births.

TABLE IV-4

Number of Live Births and Percent of Year's In-Hospital Births

by Maternity Service Size, Massachusetts, 1969-1974[a]

	1969		1970		1971		1972		1973		1974	
Maternity Service Size Births Per Year	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
≤ 500	7,988	8.4	6,201	6.4	7,575	8.5	8,346	10.6	7,960	10.7	7,962	11.1
501-1000	20,874	21.8	21,371	22.2	19,444	21.8	18,891	23.9	21,407	28.9	17,910	25.0
1001-1500	25,173	26.3	20,876	21.6	19,136	21.4	18,059	22.9	13,374	18.1	14,918	20.8
1501-2000	15,064	15.7	20,647	21.4	20,218	22.6	14,718	18.6	13,118	17.7	13,040	18.2
> 2000	26,658	27.8	27,193	28.2	22,964	25.7	19,035	24.1	18,240	24.6	17,930	25.0
TOTAL	95,757	100.00	96,288	99.99	89,337	100.00	79,049	100.00	74,099	100.00	71,760	100.01

Source: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

[a]Only hospitals with maternity units are included

2. Maternity service size, mortality, and service capabilities.

Medical specialty groups, health planning agencies and others have claimed that maternity units should have a certain volume of deliveries in order to provide high quality care.[11]

A number of studies have found that care capabilities generally recommended for high quality perinatal services are more widely available in larger size units.[22,34] Others have found inadequate care capabilities associated with smaller size maternity services.[35,36] One of the activities of the Maternity and Newborn Project was to evaluate care capabilities of maternity and newborn services in Massachusetts. It was found that care capabilities in community units varied greatly, but, in general, equipment and specialized services were more available in larger units (Chapter II-B).

The relationship between the size of a maternity service and the fetal, neonatal and perinatal mortality rates has also been extensively studied. The common finding has been that rates tend to be lowest for the larger sized units.[36,37,38,39,40,10] A study of perinatal deaths occurring in 1967-68 in Massachusetts conducted by the Committee on Perinatal Welfare of the Massachusetts Medical Society noted: "A striking inverse relationship was seen in the 0-6 day deaths when the size of the maternity unit was related to the factor of preventability."[3]

The Project attempted to improve on many of the existing mortality studies by examining the relationship between size and mortality while controlling for the mix of high-risk patients. This was done by analyzing the mortality rates for various size categories by specific birth weight groups. The results are presented in Chapter V-C. However, one of the most impressive findings was that only the largest sized maternity services (>2000 births/year) showed a statistically significant (p=.02) decrease in the neonatal mortality rate for one of the highest risk, birth weight categories (1001-1500 grams) (Table V-20). In addition, units with >2000 births per year showed a statistically significant decrease in neonatal mortality for the greatest number of birth weight groupings from 1969 to 1974.

3. Relationships between maternity service size, economics and utilization.

It is often stated that maternity and newborn services should have a certain volume of patients in order to provide high quality services in an efficient and economical way. Consequently, various clinical, planning and regulatory groups have recommended size standards for perinatal services.[10,41,42,11,34,43]

There is general agreement in most studies that maternity services delivering less than 500 births per year should consolidate or phase out unless they serve geographically isolated populations or can justify a small service on other grounds. There is also widespread agreement that the ideal size of a community hospital maternity service should be between 1500 and 2000 births per year.

Many of these studies, however, do not control for the level of perinatal care provided. High-risk, perinatal care requires expensive personnel, equipment, and services which are not needed in units providing primarily low-risk, less costly perinatal care. The volume of patients needed to support different levels of care in an efficient and economical way varies considerably. The recently issued report of the Committee on Perinatal Health contains standards for different levels of care and cost estimates for Level II and Level III perinatal services based on these standards.[11] To operate in an efficient and cost effective way the report recommends that Level II units serve a population base of 2000 births per year. Level III units should serve a catchment area of 8-10,000 births per year.

The Maternity Newborn Project did a cost analysis for maternity services with the minimum capabilities recommended for Level I (uncomplicated care) by the Committee on Perinatal Health.[11] The objective was to determine the cost for this type of unit with minimum capabilities when it was utilizing these capabilities with maximum efficiency. It was estimated that such a unit would cost approximately $860,000 per year and that 1200 patients per year would be needed to break even financially (Chapter IV-F). Units attempting to provide higher levels of care (Level II and Level III) would be expected to provide greater care capabilities, incur higher costs and require a greater volume of patients to operate efficiently.

Other studies in Massachusetts have shown an inverse relationship between maternity service size and occupancy rates[18] (Table IV-7, p.26). Smaller maternity services tend to have low rates, while units with over 1500 births per year begin to approach acceptable occupancy rates. It is interesting to note that despite the closure of 17 maternity units and 428 beds from 1971-1975, overall maternity occupancy rates have not substantially changed because of rapid decreases in the numbers of births and reductions in the ALS.

SECTION D - BIRTH PROJECTIONS

Birth projections are the most important component for projecting future maternity bed need and utilization. Live births account for 80% to 95% of admissions to maternity services and the major portion of patient days. Therefore, accurate birth projections and an understanding of the possible fluctuations in future births are essential for planning of maternity services.

There have been dramatic changes in the number of live births per year in Massachusetts over the past four decades. Live births have ranged from a low of 61,184 in 1936 to a high of 115,065 in 1957,[44] to an estimated 68,907 in 1975.[45] From 1969 to 1974, live births in Massachusetts showed a dramatic decline (24%), twice the national percentage decrease. In 1974, the Massachusetts birth rate was only 12.3, the third lowest among the states and 18% less than the U.S. birth rate of 15.0.

Past methods for projecting births in Massachusetts have generally multiplied a projected crude birth rate or general fertility rate for the State by the projected population of fertile aged women within a specific service area. This method is not sensitive to differences in fertility rates of different communities and can lead to serious over and under estimations.

Therefore, the Project calculated fertility-related data for every city and town in Massachusetts for 1970, including average number of births, total population, females 15-44 years, crude birth rate, general fertility rate, percent of women in childbearing age and percent differences from State rates.[46] There is considerable variation among cities and towns. Similar variations occur by census tract in Boston and affect the planning of fertility related ambulatory health services - for example, services provided by neighborhood health centers.

From these data, the Project developed a series of birth projections for both the State and selected cities that is sensitive to the differential fertility rates of these areas. These projections provide basic information for developing birth projections for various hospital service areas.

Six series of projected births for 1975, 1980 and 1985 are presented in Appendix IV-F. These provide a range within which actual numbers of births are expected to fall. Projected numbers of births may be interpolated or averaged in a number of ways to obtain birth projections for the intervening years. Such a series of projections is potentially more useful than a single estimate, because users can chose what appears to be the most appropriate series for a given area, check the projections against actual numbers of births as they become available, and adjust to an alternate series if indicated.

The projection methodology employed is simple but of sufficient accuracy that it can be applied easily and with confidence to update or replicate projections or to develop projections for other cities and towns. The method requires only data on population by age and sex and total births in a locality.

Births projected from 1970 to 1975 ranged from 82,296 to 70,114. The low figure was close to the actual births in 1974, and it apppears that the low series may be the most appropriate for projecting Massachusetts births. Even with the low birth projection series, an increase in State live births of approximately 25% is possible between 1975 and 1985. This would roughly be equivalent to the numbers of births in 1971.

APPENDIX IV - F

BIRTH PROJECTIONS FOR MASSACHUSETTS AND SELECTED MASSACHUSETTS CITIES,

1975, 1980 AND 1985

State and City Projection Series of Women	Projection Series of General Fertility Rates and Year								
	High			Medium			Low		
	1975	1980	1985	1975	1980	1985	1975	1980	1985
Massachusetts	82,296	106,661	111,743	75,557	95,812	101,072	70,114	81,863	87,586
Pittsfield									
High	776	943	929	723	864	874	680	765	799
Low	757	889	850	705	814	800	663	721	731
Springfield									
High	2,482	2,950	2,947	2,312	2,701	2,774	2,172	2,393	2,533
Low	2,405	2,779	2.678	2,240	2,544	2,521	2,104	2,254	2,302
Holyoke									
High	786	931	950	741	864	902	704	782	836
Low	746	837	812	703	777	771	669	703	714
Chicopee									
High	909	1,153	1,173	835	1,044	1,094	778	909	987
Low	866	1,053	1,028	797	953	960	742	830	865
Worcester									
High	2,376	2,956	2,990	2,194	2,682	2,795	2,046	2,344	2,531
Low	2,320	2,797	2,755	2,142	2,538	2,575	1,998	2,218	2,332
Fitchburg									
High	625	816	847	577	740	792	538	647	716
Low	617	791	809	569	717	756	531	627	683
Leominster									
High	580	762	855	547	707	811	519	639	751
Low	566	727	793	533	675	753	506	610	697
Haverhill									
High	669	853	887	622	781	834	584	691	761
Low	649	808	819	604	740	769	568	655	702
Lawrence									
High	1,237	1,596	1,740	1,164	1,477	1,649	1,104	1,332	1,525
Low	1,190	1,518	1,604	1,119	1,405	1,521	1,062	1,266	1,407
Lowell									
High	1,791	2,281	2,444	1,673	2,099	2,307	1,580	1,873	2,117
Low	1,722	2,122	2,190	1,609	1,952	2,067	1,519	1,742	1,897
Lynn									
High	1,303	1,557	1,534	1,203	1,412	1,434	1,121	1,234	1,296
Low	1,240	1,409	1,327	1,144	1,278	1,241	1,067	1,117	1,121
Boston									
High	9,399	12,139	12,682	8,628	10,967	11,824	8,014	9,524	10,643
Low	9,105	11,306	11,499	8,358	10,214	10,720	7,763	8,870	9,650
Cambridge									
High	1,186	1,615	1,716	1,063	1,425	1,569	962	1,188	1,375
Low	1,144	1,514	1,540	1,026	1,336	1,408	928	1,114	1,234
Somerville									
High	1,252	1,564	1,548	1,130	1,388	1,423	1,030	1,167	1,254
Low	1,190	1,422	1,337	1,073	1,261	1,229	978	1,061	1,083
Malden									
High	836	1,039	1,076	769	941	1,003	715	817	904
Low	809	973	965	744	881	900	692	765	811
Medford									
High	771	1,029	1,168	686	902	975	619	746	849
Low	754	986	1,098	671	864	917	605	715	798
Arlington									
High	638	904	1,057	565	788	877	507	647	760
Low	620	862	976	550	752	811	493	617	702
Waltham									
High	870	1,168	1,135	779	1,031	1,041	706	861	911
Low	854	1,122	1,130	765	991	1,037	694	827	907
Newton									
High	729	1,011	1,120	634	871	910	558	695	772
Low	714	969	1,045	621	835	849	547	666	721
Brookline									
High	403	530	579	357	463	481	321	380	418
Low	381	480	497	337	419	413	303	344	359
Framingham									
High	1,013	1,485	1,817	906	1,308	1,748	820	1,088	1,334
Low	968	1,356	1,581	865	1,195	1,521	783	994	1,161
Quincy									
High	1,283	1,736	1,848	1,150	1,531	1,694	1,041	1,276	1,482
Low	1,248	1,648	1,694	1,119	1,453	1,552	1,012	1,211	1,358
Weymouth									
High	824	1,148	1,343	750	1,026	1,151	689	876	1,024
Low	772	1,028	1,139	702	918	976	645	784	868
Brockton									
High	1,828	2,583	3,273	1,705	2,369	2,902	1,605	2,107	2,658
Low	1,783	2,451	2,977	1,663	2,249	2,640	1,566	2,000	2,418
Fall River									
High	1,532	1,833	2,004	1,438	1,694	1,796	1,365	1,525	1,659
Low	1,499	1,732	1,849	1,407	1,601	1,656	1,335	1,442	1,531
New Bedford									
High	1,484	1,734	1,876	1,415	1,631	1,720	1,359	1,503	1,617
Low	1,426	1,585	1,655	1,359	1,490	1,518	1,305	1,373	1,426

Source: Massachusetts Maternity and Newborn Regionalization Project

The low-low birth projection option appears most likely for most Massachusetts cities. This might result in an overall 24% increase in fertility between 1975 and 1985. It is important to emphasize, however, that birth patterns and projections for individual cities will differ from the overall trend. In addition, during this period the cities will capture fewer of the State's births. The percentage of State births occurring to residents of major cities fell from 51% in 1960 to 48% in 1970 and is expected to decline to 44% by 1985.

Birth projections developed by the Project indicate an increase in births for all six series for the State and every city studied between 1975 and 1985. This is due largely to projected increases in the number of women in the child bearing years during this period. The peak of the baby boom will reach child bearing age in 1985. After 1985 there will be a sizable decrease in the number of women of child bearing age which will result in a sharp reduction in numbers of births. To compound this decrease, the U.S. Bureau of the Census forecasts a further decline in general fertility rates nationally after 1985.

Fluctuations of live births over the next few decades are highly probable. It is essential that maternity services and fertility related health services be flexible enough to operate efficiently during both high and low volume periods. Decreases in births as much as 30% below the expected peak of the mid-1980's should be planned for as a serious possibility in the decades following 1985.

SECTION E - BED NEED

To plan effectively, it is essential to develop ways of determining the number of beds needed for maternity services. A variety of formulas have been used in the past for calculating maternity bed need. One popular method is the Public Health Service Formula.[47] However, this formula suffers from two principal defects: it does not take into account the nature of the patient arrival process and it ignores the problem of patient access to care. Therefore, a number of authorities have recommended that the Public Health Service approach be replaced for maternity and other services by formulas based on the principle that patients should have equal access to beds regardless of facility size.[41,48,49,50,51] Operationally, this means each unit has sufficient beds so that the probability of all being filled simultaneously is kept below an acceptable threshold. For example, it might be decided that a bed should be available 99% of the time (all but four days of the year) or 95% of the time (all but 18 days of the year). The 95% and 99% figures are sometimes referred to as the "service levels."

The "finite-state, birth death" queuing model has been used to plan emergency services,[52,53,54] and applies directly to maternity services. It assumes simply that patient arrivals are unpredictable and unscheduled; it imposes no restrictions on the distribution of lengths of stay; and it assumes that the number of beds is fixed. From information on average patient arrival rates, average lengths of stay and numbers of beds, the queuing model will predict occupancies and service levels.

Fortunately, the bed need predictions of the complicated queuing model, for specific service levels, can be accurately approximated by a simple formula involving only two constants (which depend on the service level) and the average daily census presented to the maternity unit. It represents the simplest formula that is an accurate approximation of the relationship between the average daily census and the bed need as predicted by the queuing model. The constants for the 95% and 99% service levels are:

99% Service Level	$K_1 = .91$, $K_2 = 2.6$
95% Service Level	$K_1 = .84$, $K_2 = 2.1$

Sample calculations using the queuing formula for an 88.9 average daily census can be seen below. The higher the "Service Level" the greater the need for beds.

Bed Need for 99% "Service Level"

$= K_1 \times ADC + K_2 \times \sqrt{ADC}$
$= .91 \times 88.9 + 2.6 \times \sqrt{88.9}$
$= 80.88 + 24.51$
$= 105$ beds

Bed Need for 95% "Service Level"

$= K_1 \times ADC + K_2 \times \sqrt{ADC}$
$= .84 \times 88.9 + 2.1 \times \sqrt{88.9}$
$= 74.7 + 19.8$
$= 95$ beds

The queuing formula has a number of advantages over the Public Health Service and other formulas in determining maternity bed need. The queuing formula leads to very nearly equal service levels (probability that a maternity bed is available) for all sizes of maternity units. In contrast, the PHS formula at 75% occupancy leads to extremely high probabilities of peak load occupancy (low service levels) for small maternity units, and extremely low probabilities (high service levels) for large units.

The queuing model indicates that fewer total maternity beds are needed than estimated by either the Normile or the Public Health Service formulae (Appendix IV-K, p. 37). The Public Health Service Formula projects fewer beds for the smaller services and more for the larger services. It overestimates the beds needed for larger services (7,000 annual admissions) by 21% in comparison to the queuing formula (at 95% "Service Level"). It underestimates the beds needed for smaller services (550 annual deliveries) in comparison to the queuing formula (at 99% "Service Level") by 40%. For intermediate-sized facilities, a 75% occupancy level is consistent with 95-99% service levels so that the bed need predictions are similar. The queuing approach allows more beds per delivery for small maternity services in order to accomodate the much higher relative variation among smaller services. Some small maternity services should exist in order to serve isolated populations, and these services should provide at least the same assurance of bed availability as the intermediate and larger sized units. The added cost to the system of a few additional beds for each of the "isolated" maternity services is insignificant compared to the savings in fewer "units of beds" needed in larger services and in multi-institutional systems.

Use of the queuing model, where "Service Level" is the determinant of bed need, means larger units would be expected to achieve higher occupancy rates than 75%. Conversely, smaller units would be expected to have lower occupancy rates because of their higher relative variation.

Substantial economies of scale can be realized for larger sized maternity units and for multi-institutional systems using the queuing model. With open staff privileges and close coordination and cooperation, two or three hospitals operating as one large multi-institutional system need fewer beds than each operating separately as individual units. Using the queuing approach, fewer beds are needed per projected admission for larger sized units, whereas the Public Health Service approach allocates beds per admission on a constant rate with no economies of scale for larger services or multi-institutional systems.

SECTION F - ECONOMICS

The rising cost of health care has been a major national concern in recent years. A primary goal of the National Health Planning and Resources Development Act (PL 93-641) is to promote health services that have a reasonable systems cost. The guidelines for future planning require a balance between high quality services that are accessible and services organized to minimize cost.

It is often stated that small maternity units cannot provide high quality services in an efficient and economical way. However, few studies have detailed breakdowns of the actual cost elements of a maternity service. Few of the articles supporting an efficient number of deliveries per year provide any methodology or documentation. The Project has broken down some of the basic cost elements of a maternity service in an effort to explain more clearly the cost implications of a small service in Massachusetts. It is important for smaller hospitals to understand the real costs of providing the "minimum capability" of care recommended by the Committee on Perinatal Health and essentially required by Massachusetts regulations.[11,14,15] The costs of maintaining such a level of care are substantial at a time when continued subsidization of underutilized services by third party payers is being seriously questioned. Application of a cost center approach will hopefully provide clinicians, administrators, trustees and planning agency boards with a better understanding of the relationship between costs and charges in these small services.

One third of all problems of labor and delivery occur spontaneously, without warning. For this reason, it is necessary that all maternity services, regardless of size, have at least minimum capabilities for stabilizing complications of labor and delivery. The Level I unit described by the Committee on Perinatal Health is representative of a service that can provide uncomplicated perinatal care and has at least "minimum capabilities" for stabilizing unexpected maternal and newborn emergencies.

The cost model developed by the Project for a Level I minimum capability unit was based on a unit with the following characteristics:

Delivery Capacity - at maximum efficiency

1100 deliveries per year
1200 admitted patients per year*

Bed Capacity -
16 post partum
16 bassinets
4 labor room beds
2 delivery rooms

Staffing Capacity - Total of 33.6 nurses needed to staff unit on a 24-hour basis, 7 days a week

21.0 RN's (one RN on each shift)
8.4 LPN's
4.2 Nurses Aides

*Includes a 10% factor for pregnancy related complications

A cost breakdown of such a unit, operating at maximum efficiency, is presented in Table IV-8 and Appendix IV- H.

TABLE IV - 8

COST OF UNIT AT MAXIMUM EFFICIENCY
(1200 Admissions Per Year)

DIRECT COSTS	$(000)	VARIABLE COSTS	$(000)
Salaries & Wages	424	Special Services	178
Special Services		Other Expenses	37
Lab & blood work		Dietary (Patients) (12,000 meals @ $1.86/meal)	23
Cytology			
Radiology			
Pharmacy		Laundry	26
Anesthesia		Medical Records	6
TOTAL SPECIAL	178	Med & Surg Supplies	7
Other Expenses			
Service contracts			
Supplies			
Printing			
Travel			
Personal			
TOTAL OTHER	37		
TOTAL DIRECT	639	TOTAL VARIABLE	277
INDIRECT COSTS			
Dietary (Patients)	23	FIXED	
Administration & General	32		
Sq. Footage		Salaries & Wages	424
Heat		Administration & Depreciation (comptroller, purchasing, data costs)	32
Repair			
Maintenance			
Housekeeping			
Plant			
TOTAL SQ. FT.	6	Sq. Footage (maintenance, housekeeping & operation of plant)	6
Other Costs			
Laundry 26			
Medical Records 6			
Social Service 1		Social Service	1
Med-Surg Supplies 7		Nurse Educ.	7
Nurse Educ. 7			
TOTAL OTHER	32		
TOTAL INDIRECT	107	TOTAL FIXED	470
TOTAL DIRECT AND INDIRECT	747	TOTAL VARIABLE & FIXED	747
5% (Loading & Depreciation)	37	5% (Loading & Depreciation	37
	784		784
2% (Bad Debts)	16	2% (Bad Debts)	16
5% (Free Care)	39	5% (Free Care)	39
3% (Contractual Discounts)	24	3% (Contractual Discounts)	24
	≅ 863		≅ 863

It is important to stress the difference between direct versus indirect costs and variable versus fixed costs. Salaries and wages and in-house nursing education are fixed costs under the model because a Level I unit is defined by the size of the staff complement needed to provide minimum care capabiliities. In order to meet basic Level I standards, the number of nurses must be at least 33.6 full time equivalents even if the patient load is so small as to keep the staff idle much of the time. Variable costs are those which change with patient loads, such as meals, laundry and supplies. Direct costs are those which occur as a result of the unit's existence. Indirect costs are those which the unit incurs by making use of already existing general resources servicing many hospital divisions. A fair portion of these costs are allocated to the unit.

The total annual cost of this unit is approximately $784,000 (Table IV-8). Added to these costs are bad debts (2%), free care (5%) and contractual discounts (3%). These produce a total "cost" or revenue to break even of $860,000 with 1205 admissions ($714 per admission and $192 per diem). The greatest part of the cost is for labor/delivery (35%), followed by post partum (27%) and the nursery (14%).

PROJECTED COST OF LEVEL I MATERNITY SERVICE

	POST PARTUM	LABOR/ DELIVERY	NURSERY	OBS SPECIAL	NURSERY SPECIAL	TOTAL
STATISTICS						
Admissions	1,205		1,095			
Length of Stay	3.7		4.0			
Patient Days	4,489		4,380			
Square Feet	2,855	2,066	881			
Deliveries		1,095				
OPERATING COST						
Direct Cost			80,526			423,835
Salaries and Wages	125,774	217,535	9.943			37,088
Other Expenses	14,309	12,836			65,322	177,768
Special Services				112,446		
Total	140,083	230,371	90,469	112,446	65,322	638,691
Indirect Costs						
Dietary (Patients) 100%	22,534					22,534
Administration and General	8,775	17,118	8,752			31,645
Square Feet (Heat, Repair, Maintenance, Housekeeping Plant	3,054	2,209	943			6,206
Other Costs	23,976	11,292	10,389			45,657
Sub Total	198,422	260,990	107,553	112,446	65,322	744,733
Loading & Depreciation	9,921	13,050	5,377	5,622	3,266	37,236
TOTAL COSTS	208,343	274,040	112,930	118,068	68,588	781,969
ADD Bad Debts 2%	4,167	5,480	2,258	2,361	1,372	15,639
Free Care 5%	10,417	13,702	5,647	5,903	3,429	39,099
Contractual Discount 3%	6,250	8,221	3,389	3,542	2,058	23,459
Sub Total	20,834	27,403	11,293	11,806	6,859	78,197
REVENUE FOR BREAKEVEN	229,177	301,443	124,223	129,874	75,447	860,166
Per Unit						
Per Admission	190.35	275.29	113.45	107.82	62.64	714.13
Per Diem	51.05	67.15	28.36	28.93	17.23	191.62

1. Approximate subsidization.

Discussions with administrators and comptrollers suggest that approximately 60% of the costs of operating a Level I maternity unit at maximum efficiency are fixed costs and 40% are variable costs. According to our model, total revenue needed to break even is approximately $860,000 at 1205 admissions per year, based on the estimated annual revenue needed to operate such a unit. If 60% of this cost is fixed (including the 10% allowance for bad debts, free care and contractual discounts) then approximately $516,000 /(.6) x $860,000 = $516,000 or $470,000 + (.1) x $470,000 = $517,000/ is the fixed element of the breakeven revenue. It does not change with variation in patient load.

The actual total revenue needed to break even is dependent upon the number of patients serviced. The variable cost associated with each admission is 40% of the per admission breakeven revenue (.4) x ($714) = $286. This is the differential cost generated with each admission.

Total breakeven revenue can vary greatly with patient load.

1205 patients	$516,000 + (1205) ($285) = $860,000
200 patients	$516,000 + (200) ($285) = $573,000

Actual revenue generated is a function of the fixed charge and the number of patients. Assuming the same fixed charge of $714:

1205 patients	($714) x (1205) = $860,000
200 patients	($714) x (200) = $143,000

Subsidization will be needed for a Level I unit that is operating below the breakeven patient load of 1205 admissions per year. The lower the number of admissions, the higher the subsidy required (Appendix IV-J). Subsidies over $400,000 per year are possible as illustrated by the 200 patients per year example above. Losses of this magnitude cannot be justified for small services when an option such as consolidation exists. Third party subsidization of these services should only occur when consolidation is not possible, for example, units serving isolated populations.

2. Lower charges in service closing.

Some small maternity services maintain that it would not be economically wise for them to close. One argument cites increased costs to the patient at an alternative maternity service if the smaller service with lower charges closes. Some small maternity services are not yet providing the minimum levels of recommended staffing. Increasing care capabilities to the minimum Level I will cause increased costs for many of these services. Secondly, the charges in some of these small services do not reflect their costs. In an effort to attract more patients, some services have artificially low charges, below the level of cost for providing minimum care capabilities. Smaller services, especially those less than 500 deliveries per year, cannot provide the Level I care without substantial subsidization (Appendix IV-J).

APPENDIX IV - J

ESTIMATED LOSS PER YEAR OF PROVIDING LEVEL I CARE BY MATERNITY SERVICE SIZE

Admissions Per Year (1)	Fixed Cost 60% (2)	Variable Cost[1] (3)	Revenue Needed (4)	Estimated Revenue[2] (5)	Loss Per Year (6)
1,204	516,096	344,064	860,160	860,160	--
900	516,096	257,193	773,284	642,600	-130,689
800	516,096	228,616	744,712	571,200	-173,512
700	516,096	200,039	716,135	499,800	-216,335
600	516,096	171,462	687,558	428,400	-259,158
500	516,096	142,885	658,981	357,000	-301,981
400	516,096	114,308	630,404	285,600	-344,804
300	516,096	85,731	601,827	214,200	-387,627
200	516,096	57,154	573,250	142,800	-430,450

[1]Approximately $285.77 per admission

[2]A charge of $714.00 was used for all services

APPENDIX IV - K

SAMPLE BED NEED ESTIMATES FOR SELECTED MASSACHUSETTS MATERNITY SERVICES

BASED ON 1974 FY CENSUS DAYS

Hospital	Census Days	PHS (1) 75%	Queing Theory Formula (2) .95	(3) .99	(4) Actual Beds
1	6,039	22	22	26	28
2	19,493	71	59	67	94
3	6,859	25	24	29	25
4	7,417	27	26	30	34
5	6,739	25	24	28	36
6	6,735	25	24	28	37
7	7,502	27	26	31	36
8	6,443	24	23	27	41
9	7,935	30	27	32	34
10	11,418	42	37	43	49
11	17,472	64	54	61	86
12	10,887	40	36	41	45
13	32,439	119	94	106	108
14	8,183	30	28	33	30
15	5,888	22	21	25	18
16	7,496	27	26	31	33
17	6,287	23	23	27	31
18	5,839	21	21	25	26
		664	595	690	791

3. Gynecology admissions.

Some maternity services claim they cannot afford to lose the income from clean gynecological admissions to the maternity service. A hospital can continue to admit gynecological patients without a maternity service. Gynecology admissions to a maternity service have been encouraged only for use of beds during low volume periods. Some hospitals have abused this use and have as many as 30% to 40% of their maternity service admissions and patient days filled with gynecology patients. The clean gynecology patient uses only a small part of the total maternity-newborn unit, not the costly labor/delivery and nursery areas. Heavy clean gynecology use of the maternity service is an inefficient use of this costly space.

4. Savings due to closure.

If the Level I unit described in Table IV-8 were to close, it is likely that a significant part of the $305,000 (variable cost + 10% for bad debt, free care, and controlled discount) would be transferred to other units which would assume the responsibility for future deliveries.

It is also probable that a large component of the fixed cost of $516,000 (fixed + 10% bad debts, etc.) could be eliminated, promoting increased efficiencies within the maternity and newborn system itself. However, the extent to which the total health system realizes savings is a function of the ability of the total system to absorb and allocate these resources more efficiently.

The savings due to the closure of 14 maternity services in Massachusetts in the past two years can be estimated in the following way. Savings realized by the maternity and newborn system can be largely attributed to the elimination of the fixed costs of the closed services. The savings to the maternity and newborn system on a yearly basis due to these closures would be approximately $7 million. Estimated savings to the total system would depend on whether the fixed costs were totally eliminated or efficiently utilized in other areas of the health care system.

5. Costs of alternative bed need formulas.

A major focus of certificate of need laws is to limit excessive expansion of health facilities and hospital beds while providing enough high quality services to meet the patient need. Overestimations of bed need can be very expensive in the long run to the taxpayer and insurance subscriber. The capital construction costs of a maternity bed have been estimated to be approximately $160,000 and the operating costs approximately $50,000 per year in 1976.[55]

The Project attempted to explore these cost implications for various bed need formulas. Bed need estimates were calculated for the 18 largest maternity services in Massachusetts in F.Y. 1974 using the Public Health Service Formula and the Queuing Formula at "Service Levels" of 95% and 99% (Appendix IV-K). The assurance of having beds available at the 99% level would cost approximately 75 million constant dollars more than at the 95% level over a twenty year period. The 69 bed excess using the Public Health Service formula at 75% as compared to the Queuing Theory Formula at 95% assurance would result in $55 million more 1976 dollars for a projected twenty year period. The key decision for policy makers is to balance these cost estimates with the need for availability of services.

SECTION G - CONSOLIDATION OF MATERNITY AND NEWBORN SERVICES

The number of maternity services in Massachusetts has declined from 120 in 1960 to 65 in 1975 (Appendix IV-L). In just the past two years, 14 maternity services have closed, and two more have merged although both units are still operating. As of December 1976, there were 61 maternity services in Massachusetts.

There are at least two reasons for consolidation of maternity services: (1) the consolidation of small, less efficient units, which often provide only minimal services, to form larger units which can provide a more comprehensive range of services in a more efficient and economical way and (2) to form maternity and newborn services with a sufficient volume of patients and range of services that they can provide high-risk perinatal care. Some small services are needed due to geographic isolation and they should have assistance in planning and supporting their limited services. Other units should be encouraged to consolidate.

Various factors have contributed to the nearly 50% decrease in maternity services. There has been a 40% decrease in live births in Massachusetts from 115,000 (1957) in the peak of the "baby boom" to 68,907 (1975) in the "birth-dearth" period.[44,45] In the early 1970's there was a 24% decrease in live births, nearly twice the national decrease. As a result many maternity services have experienced severe underutilization and economic hardship.

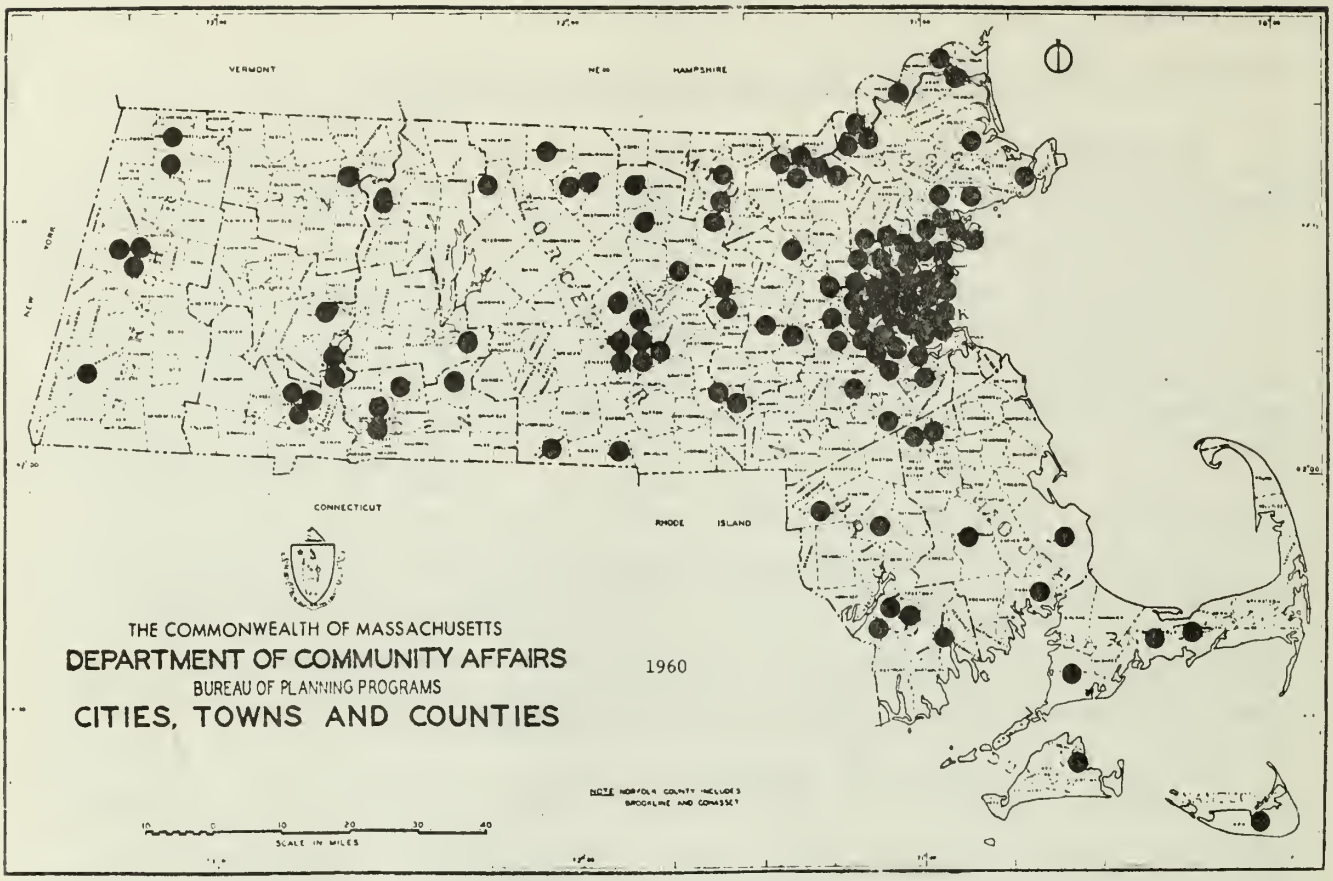
In addition, clinical and technological advances have led to new standards for maternity and newborn services and differentiation by levels of care.[11,12,15] All services must maintain at least minimum capabilities for the provision of normal perinatal care and the stabilization of emergencies. The cost of a Level I, minimum care unit has been estimated by the Project to be approximately $860,000 per year. When such units are underutilized, they must be subsidized. It is becoming increasingly difficult to justify such subsidization when consolidation is feasible.

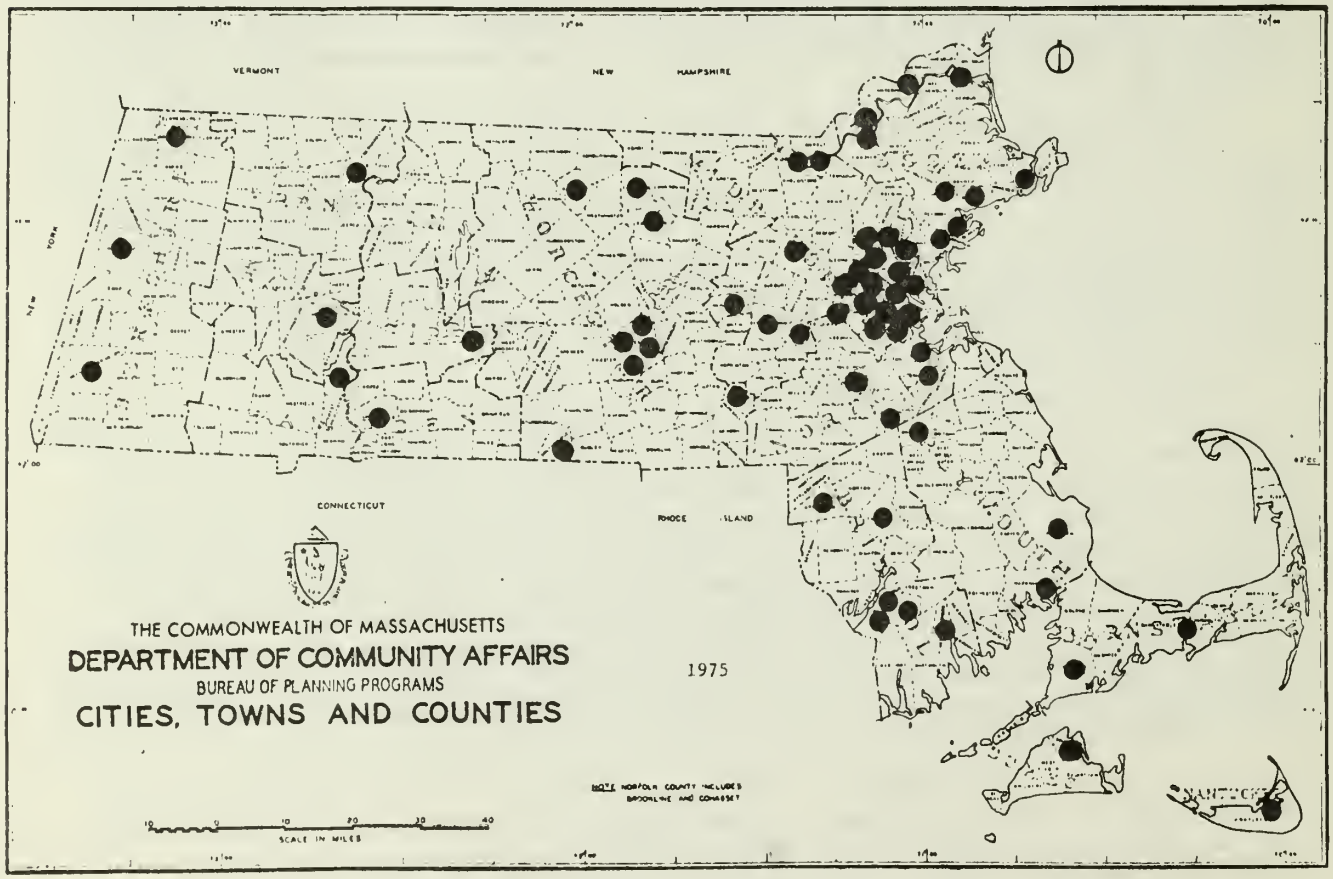
Concerns over inefficient and costly utilization have led to efforts on the part of health planning groups, the State Certificate of Need Program, third party payers, the Rate Setting Commission and others to promote consolidation of small maternity services in Massachusetts.[2,32] The State Department of Public Health has also prompted the phasing out of many small units through enforcement of licensure regulations.[14,15] Finally, outstanding obstetricians and pediatricians have encouraged consolidation through educational programs and consultation to community hospitals and physicians.

Despite considerable consolidation, little objective information was available on the causes, process and results of the closure of maternity services. Therefore, the Project and the Massachusetts Hospital Association collaborated on a survey of the hospitals in Massachusetts that had closed maternity services between 1960 and 1975. Issues addressed were: forces leading to the decision to consolidate, economic considerations and impact, groups for and against consolidation, effect of closure on other hospital services and the medical staff, subsequent use of maternity space, and impact on primary care services. Because hospitals that closed maternity services between 1970 and 1975 provided better data and a higher response rate (75%), and the experience of these hospitals was more relevant to present conditions, the analysis was limited to the questionnaires returned for this period.

Nearly half of the maternity services reporting (5/11) had occupancy rates of 30% or less prior to closing. Approximately one third of the services (4/11) were ten beds or less and 45% (5/11) had 300 or less deliveries per year. Twenty-five percent (3/12) had 100 or less beds in the hospital.

APPENDIX IV-L





LOCATION OF MATERNITY SERVICES IN MASSACHUSETTS, 1960 AND 1975

The reported effects of the closure on other hospital services varied. In most cases, usage of general surgery, medical-surgical beds and lab services showed a general increase, while use of anesthesia services remained the same. Gynecological surgery and pediatrics showed either a decrease or no change in utilization. Availability of outpatient services, including obstetrics and gynecology, remained unchanged in all but one case which showed considerable improvement.

In nearly all of the cases, the administration and trustees were in favor of closing the maternity service. Other groups in favor included medical/surgical physicians, health planning agencies, and the State Department of Public Health. The major groups opposed to closure were the obstetricians and obstetrical nurses. Other groups disapproving included pediatricians, medical/surgical physicians, other physicians and community groups.

The decisive factor mentioned most often as influencing the final closure was cost. Other factors included low occupancy, decreasing admissions and staffing problems, such as retirement or relocation of physicians. Factors mentioned in opposition to closure included: increased travel time for patients and physicians, decline in patient base and loss of future pediatric patients.

A variety of techniques were used by most hospitals in reaching a final decision. These included: study committees; consultants; and meetings with the medical staff and obstetrical staff, local elected officials, health planning agencies and the State Department of Public Health.

Ten out of eleven hospitals reported operating at a loss at the time of closure. Some of the losses reported ranged from $50,000 to $168,000. Estimated percentages of the costs of the service not recovered ranged up to 50%. Most reported that the closure had no effect on the economic situation of other services, but nearly all noted improvement in the financial status of the hospital as a whole. One of the reasons cited for this was the replacement of a heavy loss service with a breakeven service or program.

Two thirds of the hospitals reported using the previous maternity space for medical/surgical beds following closure. Other uses included: short stay surgery, physical therapy, respiratory therapy, expanded prenatal care and women's clinics, pediatric care, surgical pediatrics, special care (alcoholism, emotional problems, etc.), library, administrative space, pharmacy, respiratory therapy and coronary care.

The obstetrical staff in these services ranged from 1 to 5 physicians, the average being 4. In most cases, the majority of the staff regularly performing deliveries were Board-certified obstetricians and gynecologists.

All of the reporting hospitals absorbed at least one half of the obstetrical nurses through retraining and reassignment. In some cases, nurses retired or transferred to another maternity service. A third of the services absorbed all of the nursing staff.

Sixty-four percent of the respondents indicated that their former maternity patients now travel an average of 15 minutes or less to the nearest hospital with a maternity unit. The remainder reported a travel time of 30-40 minutes.

Recommendations - Chapter IV

Section A - Travel Time

The Project recommends the following travel time standards for maternity and newborn services in Massachusetts.

1. Prenatal care services within twenty minutes.

2. A community-based, maternity-newborn service within thirty minutes.

3. High-risk perinatal intensive care within sixty minutes. In addition, every maternity unit in the State should have access to a neonatal intensive care unit within sixty minutes.

Section B - Average Length of Stay

1. Calculations of average length of stay should be sensitive to patient mixture and level of care provided. These calculations should include the four basic ICDA categories: deliveries without complications, deliveries with complications, complications of pregnancy and induced abortions.

2. The Project recommends the following average length of stay levels for projecting future utilization rates for Massachusetts maternity services:

   Deliveries without complications (ICDA 650) - 3.22
   Deliveries with complications (ICDA 651-661) - 4.34
   Complications of pregnancy (ICDA 630-634) - 2.26
   Abortions (ICDA 640-645) - 1.68

3. Average length of stay levels should be updated annually.

Section C - Size

The Project recommends three size standards for maternity-newborn services in Massachusetts.

Standard I - Maternity services in Massachusetts delivering approximately 500 births per year or less should close or consolidate as soon as possible.

Maternity services providing care for "isolated areas" should be exempted from this standard. One parameter of geographic isolation that the Project recommends is a travel time of more than 30 minutes to an alternative maternity service. Additional parameters such as climatic factors should be developed on a local and regional basis. In addition, standards for the minimum number of patients needed to justify the operation of a maternity unit, even if geographically isolated, should also be explored. Small maternity and newborn units that are designated as needed because of geographic isolation or other reasons, should receive waivers from State Health Department regulations (as long as these do not jeopardize the health and and safety of patients) and should receive special reimbursement from State and third party payers for their needed services.

Standard II - The immediate objective for most maternity services in Massachusetts should be at least 1000 deliveries per year.

Standard III - The long term objective for maternity and newborn services in Massachusetts should be projected toward a delivery level of approximately 1500 births per year. This standard should be used in any decisions that have a long term impact on the health system, such as the construction of new maternity services.

In order to achieve Standards II and III, the possibility of merger or consolidation should be thoroughly explored. In some areas mergers and consolidations are possible immediately; in others, it will be necessary to take incremental steps toward this goal.

It is recognized that there are some maternity services that will be needed in the future that will never be able to meet these size standards. Perinatal centers, community maternity services and Health Systems Agencies should begin to plan for the ideal size and distribution of maternity services in their areas and to define unique local or regional conditions that might exempt services from these recommended standards. In general, these standards should be used as guidelines for planning maternity and newborn services on a regional and statewide basis, but they should be applied with flexibility and sensitivity to local and regional variations and needs.

Section D - Birth Projections

1. It is recommended that the birth projections developed by the Project be used as a basis for the development of birth projections for hospital maternity service areas. A range of projected births should be calculated and adjusted over time in accordance with actual fertility experience.

2. Future maternity service construction and renovation should take into consideration anticipated long range fluctuations in births.

Section E - Bed Need

1. The queuing bed need formula should be used in determining the need for maternity beds in Massachusetts.

2. Multi-institutional systems called for in Public Law 93-641 should be developed for maternity services in Massachusetts and the queuing bed need approach used to determine bed need for these systems.

Section F - Economics

Similar cost studies directed to commonly asked questions and understandable to lay policy makers should be developed.

Section G - Consolidation

A few additional, small, maternity services in Massachusetts should consolidate in the near future. Several larger services (> 1000 births per year) should also consolidate into Level II or III perinatal units with the capability of providing "high-risk" obstetric and newborn care. Specific recommendations are described in Chapter VI - Regional Perinatal Programs.

CHAPTER VI
DATA AND STATISTICS

SECTION A - PRENATAL CARE

Regional organization of maternity and newborn care traditionally has focused on the institutional components of the system. The preventive capabilities of the ambulatory components of maternity care have received less attention.

The importance of prenatal care has been heightened by recent advances in fetal/maternal techniques for assessing growth, maturity and condition of the fetus in utero and new methods of preventing and treating problems identified during the prenatal period.[7,59] Therefore, prenatal care is an important mechanism to identify: (1) pregnancy problems that are preventable or treatable, and (2) those women and fetuses most likely to have problems in labor, delivery and the neonatal period so that they can be prebooked for care at a perinatal center.

In its study of perinatal mortality in 1967-68, the Perinatal Welfare Committee of the Massachusetts Medical Society found that 19% of the fetal deaths and 18.6% of the first week neonatal deaths were either "definitely" or "possibly" preventable due to factors related to prenatal care. Another 14.3% of fetal deaths and 6.4% of the first week neonatal deaths were considered preventable if major problems of pregnancy had been found or reported.[3] Other studies have found that early and continuous prenatal care is an important factor in reducing complications of pregnancy and neonatal mortality.[56,57,58]

Recognizing the importance of prenatal care, the Project examined the "adequacy" of the prenatal care received by Massachusetts women during the years 1970-1974. The purpose was to identify cities and towns where the "adequacy" levels were low and where little improvement had been seen. The Standards of the World Health Organization[60] and the American College of Obstetricians and Gynecologists[61] were used. Both organizations recommend that women begin prenatal visits in the first trimester. Visits should be made monthly for the first 28 weeks, every two weeks until the 36th week, and then weekly until delivery. The definition of the term "adequate" and other levels of prenatal care were adopted from Kessner's Study of New York City Events.[62] These definitions were based on the following items found on the live birth certificate: trimester of first prenatal visit, number of prenatal visits, birthweight, date of birth, and first day of last menstrual period. The number of visits, trimester of first prenatal visit and the first day of the last menstrual period are all reported by the mother, and although checked by the physician, are subject to the limitations of recall.

Different combinations of trimester of first visit and number of visits, controlled for length of gestation, were used to develop an index of three levels of prenatal care: "Adequate," "Inadequate," and "Intermediate." This "adequacy" of prenatal care index cannot be considered a comprehensive measure of the quality or continuity of the prenatal care received and should not be used for anything more than identifying areas meriting further investigation.

This information was examined for a 10% sample of all live births for the years 1970-1974. The sample included births occurring in Massachusetts hospitals and births occurring to residents of Massachusetts cities and towns. Births to residents occurring outside the State were not included. Census tract data for Boston were also examined.

The length of gestation (the difference between the first day of the last menstrual period and the date of birth) was used as a control on the number of visits.

However, in a run of the 1974 sample, 17.7% of the live birth certificates had incomplete reporting for the first day of the last menstrual period. Therefore, birth weight, which was reported with nearly 100% completeness, was used as a proxy for gestation. Birth weights were translated into weeks of gestation using the 90th percentile on the Lubchenco curve.

The Project produced a report that lists the number and percentage of the live birth sample that received "adequate," "inadequate," and "intermediate" levels of care for every city and town in the State as well as every hospital and census tract for the City of Boston. The State Office of Comprehensive Health Planning and the Health Systems Agencies have worked with the Project to produce preliminary descriptive mapping of selected cities and towns with regard to (1) the percent of women receiving "adequate" prenatal care and (2) the improvement in the percentage of women receiving "adequate" prenatal care from 1970-1974. This exercise in mapping allowed at least one person in each planning agency to begin working with the data.

The number and percent of women receiving "adequate" prenatal care for the larger cities in Massachusetts are presented in Appendix V-D. Improvements over time were evaluated by using the linear trend chi-square test.[33] During the period 1970-74, Massachusetts showed a statistically significant improvement ($p<.003$) in the level of "adequate" prenatal care. The percent increased from 65% to 79%. Boston reflected the most significant improvement ($p<.003$), with "adequate" levels increasing from 49% to 69%. The second greatest improvement was for Somerville ($p< .003$), which increased the level of "adequate" care from 46% to 86%. Other cities showing statistically significant improvements ($p<.05$) were: Brockton, Brookline, Framingham, Lowell, Malden, Newton, Waltham, Worcester, Chicopee, New Bedford, Quincy and Weymouth (Appendix V-D).

Of the 9 large cities in Massachusetts with statistically significant improvements ($p<.05$) in perinatal mortality, 7 showed improvements in levels of "adequate" prenatal care that were statistically significant or close to it. Boston, Somerville and Lowell showed significant improvements ($p<.003$) in both perinatal mortality and level of "adequate" prenatal care.

A finer level of analysis is needed for cities to identify specific areas where prenatal care has been inadequate and little improvement has been observed. Therefore, the Project used census tract coded vital events that are available for Boston and has worked with groups interested in evaluating changes and assessing priority areas within the city. These include: the Title V Maternal and Infant Care Project of the State Department of Public Health, the Massachusetts League of Neighborhood Health Centers, the Department of Community Health Services of the Department of Health and Hospitals of the City of Boston, and the Health Planning Council of Greater Boston.

Boston has shown the most significant improvement in the level of "adequate" prenatal care of the major cities in Massachusetts. The most significant improvements from 1970-1974 were found for Roxbury ($p<.003$), South End ($p<.003$), West Roxbury ($p<.003$) and North Dorchester ($p<.003$). Significant improvements were also found for Allston/Brighton ($p=.004$), South Dorchester ($p=.013$), South Boston ($p=.014$), Charlestown ($p=.015$) and Jamaica Plain ($p=.046$).

The Maternal and Infant Care Project has begun to evaluate changes in improved "adequacy" of prenatal care received in "MIC" census tracts in Boston. The high-risk "MIC" census tracts show a statistically significant increase in "adequate" prenatal care and a decrease in "inadequate" prenatal care. A major part of the improvement in Boston's levels of "adequate" prenatal care can be attributed to the prenatal care programs of the neighborhood health centers. These data should be helpful to these centers in evaluating the level of "adequate" prenatal care being received by women from their service area census tracts.

LEVELS OF "ADEQUATE"[1] PRENATAL CARE RECEIVED BY MASSACHUSETTS WOMEN, 1970-1974

	Region	Percent of Women in Ten Percent Sample Receiving "Adequate" Prenatal Care					Number of Women in Ten Percent Sample ("Adequate"/Total) Receiving Prenatal Care					Linear Trend Chi	p
		1970	1971	1972	1973	1974	1970	1971	1972	1973	1974		
Arlington	3	80	79	78	77	85	64/80	44/56	49/63	47/61	39/46	.304	.734
Boston	6	49	57	63	63	69	519/1056	544/954	556/878	500/798	564/819	8.965	<.003
Brockton	7	60	68	77	74	78	105/175	109/161	135/176	104/141	121/156	3.728	<.003
Brookline	6	42	67	80	80	78	22/52	20/30	32/40	33/41	28/36	4.096	<.003
Cambridge	3	57	66	68	72	67	78/137	87/132	78/115	72/103	50/75	1.842	.066
Chicopee	1	74	65	64	80	85	78/105	65/100	68/106	70/87	56/66	2.08	.038
Fall River	7	62	54	34	45	65	112/180	99/182	61/178	71/158	86/132	.908	.327
Framingham	5	74	81	88	92	88	79/107	79/97	74/84	80/87	87/99	3.358	<.003
Holyoke	1	63	55	57	64	58	41/65	41/74	44/77	37/58	48/83	0.138	.889
Lawrence	8	66	65	71	74	71	85/128	82/126	86/121	81/110	84/118	1.364	.174
Lowell	8	48	59	56	65	64	83/172	106/179	99/176	102/158	101/157	3.083	<.003
Lynn	4	70	73	68	77	79	117/166	116/158	84/123	98/128	87/110	1.597	.110
Malden	4	58	65	72	68	83	59/102	55/84	47/65	50/73	52/63	3.15	<.003
Medford	4	66	75	78	75	80	67/101	69/92	42/54	47/63	60/75	1.883	.06
New Bedford	7	71	69	72	81	79	109/154	118/171	107/148	113/140	117/149	2.418	.016
Newton	5	64	79	83	90	89	60/94	68/86	59/71	43/48	68/76	4.361	<.003
Pittsfield	1	77	76	79	78	84	71/92	57/75	64/81	50/64	67/80	1.074	.285
Quincy	5	69	78	79	83	83	104/150	108/139	90/114	73/88	86/104	2.74	.006
Somerville	3	46	64	74	72	84	72/157	90/141	86/117	91/126	81/97	6.42	<.003
Springfield	1	64	67	66	67	73	196/306	190/284	167/252	159/239	154/211	1.792	.073
Waltham	3	57	71	71	79	84	63/111	62/87	54/76	58/73	59/70	4.214	<.003
Weymouth	5	73	76	80	85	88	62/85	63/83	63/79	56/66	59/67	2.659	.008
Worcester	2	62	63	72	70	76	188/303	170/270	171/238	173/246	186/244	3.974	<.003
State of Massachusetts	-	65	70	72	76	79	5807/8944	5753/8253	5254/6957	5254/6957	5689/7247	20.752	<.003

Source: Live Birth Certificates, Office of Health Statistics and Analysis
Massachusetts Department of Public Health

[1]The "adequate" level of prenatal care is based on standards of the World Health Organization and the American College of Obstetricians and Gynecologists. It replicates a method used in "Infant Death: An Analysis by Maternal Risk and Health Care." The index is derived from the following live birth certificate items: the number of prenatal visits, the trimester of the first visit and the birth weight of the infant.

SECTION B - TRANSFER SYSTEMS AND DATA

Provision for safe transport of high-risk obstetric and newborn patients is an essential part of regionalization of maternity and newborn programs.[2] Massachusetts is a relatively small, densely-populated state and transport can be accomplished largely through ground vehicles. At the present time, most transport involves sick neonates and is primarily arranged by the neonatal transfer nurseries. The availability of vehicles and payment for services have been identified as problems in some areas. The Project made contact with the Emergency Medical Services Program in Massachusetts and discussed the development of regional perinatal programs, including identification of high-risk centers, referral networks and transport problems with them.

Whenever possible, high-risk patients should be identified early and delivered in a perinatal center where a full range of intensive fetal, maternal and neonatal services are immediately available.[63] However, approximately 40-50% of neonatal complications are not predictable. Consequently, a certain portion of neonates will require transportation in any regionalization program.[64,65,66]

The estimated percentage of newborns requiring transfer to intensive care units varies from 1% to 8%.[59,64,67,68,66,10] A number of factors affect the percentage of newborns needing transfer: (1) the level of prebooking of high-risk mothers for delivery at perinatal centers, (2) the distribution of high-risk characteristics in the population served, and (3) the care capabilities of the hospitals involved. For example, Level I units should transfer nearly all problem cases, while a large Level II unit would be expected to care for certain types of high-risk patients.

In 1970, the Massachusetts Department of Public Health encouraged the transfer of high-risk newborns to neonatal intensive care units by adopting regulations requiring official designation of transfer centers and plans for the management and transfer of high-risk newborns when indicated.[15]

The Project examined the neonatal transfer experience in Massachusetts between 1972 and 1974 and the relationship between the transfer activity of community hospitals and their neonatal mortality rates. Since 1972, the Department of Public Health has collected data on newborn transfers through the Annual Hospital Statistical Report. Table V-1 shows the number and rate of newborn transfers from community hospitals to neonatal intensive care units.

TABLE V-1

Number of Newborn Transfers From Community Hospitals to Neonatal Intensive Care Units, Total Births, Births 1000-2000 Grams and Transfer Rates Massachusetts, 1972-1974

Year	State Total Annual Transfers	Total[a] Births	Transfers per 100 Total Births	Births[a] 1000-2000 g	Transfers per 100 Births 1000-2000 g	Neonatal Intensive Care Units Receiving Transfers								
						Boston Hosp. for Women	Children's Hospital Medical Center	Tufts New England Medical Center	Mass. Gen. Hosp.	Wesson Women's Hosp.	St. Marg's. Hosp.	Worc. Mem. Hosp.	St. Anne's Hosp.	Other
1972	536	61,927	0.87	1087	49.31	2	249	137	63	28	2	2	10	43
1973	718	57,702	1.24	1008	71.23	19	198	161	162	90	5	-	53	30
1974	819	53,667	1.53	--	--	22	193	184	164	82	7	27	40	100
Total	2073	---	Not Available		---	43	640	482	389	200	14	29	103	173

[a]"Total Births" and "Births 1000-2000 grms." for the Regions and State include births in all community hospitals Transfer figures are based on fiscal year October 1-September 30. All birth figures are based on calendar year, January 1-December 31.

Source: Massachusetts Department of Public Health, Annual Hospital Statistical Report.

Table V-2 shows the number of newborn transfers and the percentage change from 1972 to 1974 by Comprehensive Health Planning Region. There was an overall rise of 56.5% from 1972 to 1974 in the number of neonates transferred from community hospitals to intensive care units.

TABLE V-2

NUMBER OF NEWBORN TRANSFERS FROM COMMUNITY HOSPITALS TO NEONATAL INTENSIVE CARE TRANSFER CENTERS, BY MASSACHUSETTS REGIONS, 1972-1974 FY

Region	1972	1973	1974	Percentage Change 1972 to 1974
1	57	101	104	+82.5
2	50	74	86	+72.0
3	36	50	62	+72.2
4	124	132	165	+33.1
5	68	97	107	+57.4
6	10	25	49	+390.0
7	124	163	196	+58.1
8	57	75	75	+31.6
STATE	523	705	819	+56.5

Source: Annual Hospital Statistical Report, Office of Health Statistics and Analysis, Massachusetts Department of Public Health

A number of studies have found significant reductions in neonatal mortality in community hospitals that have "active" transfer relationships with high-risk centers.[67,69] The percentage of community hospital births resulting in neonatal deaths in intensive care units is one indicator of the "activity" of the community hospital's newborn transfer relationship with neonatal intensive care units. The higher the percentage of a community hospital's live births eventually resulting in neonatal deaths in a high-risk center, the more "active" that hospital's transfer relationship.[69] Hospitals not "actively" transferring newborns or keeping them too long would be expected to have a higher percentage of neonates die in the hospital of birth.

This measure was used to study the level of transfer "activity" of community hospitals in the different regions of the State (Table V-3). The percent of infants born in community hospitals and dying in "transfer centers" has increased in Massachusetts from 1972-1974 from 25.5% to 38.5%. This was more than a 50% increase over three years. The Regions with the highest three-year averages were Region 3 (36.3%), Region 4 (34.7%), Region 5 (35.1%) and Region 8 (35.2%). The greatest percent change over the three-year period was for Region 6 (162.6%), Region 1 (122.7%), Region 3 (115.3%), Region 2 (95.3%) and Region 8 (93.3%).

It should be noted that infants born in Massachusetts but dying out of state were included in the non-transfer category because information on the specific hospital of death was not available. This would have its greatest impact in Region 7 because of increasing use of the transfer center in Providence, Rhode Island.

TABLE V-3

PERCENT OF COMMUNITY HOSPITAL NEONATAL DEATHS OCCURRING IN NEONATAL INTENSIVE CARE UNITS, BY MASSACHUSETTS REGIONS, 1972-1974 FY

Regions	1972	1973	1974	Three Year Average	Percent Change 1972 to 1974
	%	%	%	%	%
1	19.8	16.9	44.1	25.5	122.7
2	19.3	24.6	37.7	25.6	95.3
3	25.5	28.8	54.9	36.3	115.3
4	30.1	35	39.5	34.7	31.3
5	30.0	38.9	37.1	35.1	23.7
6	18.2	22.2	47.8	30.2	162.6
7	29.0	27.0	22.0	26.4	-24.1[4]
8	27	30	52.2	35.2	93.3
STATE	25.2	26.6	38.5	29.7	52.8

Source: Matched Birth-Death Certificates, Office of Health Statistics and Analysis, Massachusetts Department of Public Health

In addition, maternity and newborn services were aggregated into three categories for neonatal mortality analysis: (1) hospitals providing in-house obstetric and neonatal intensive care (high-risk centers), (2) community hospitals with greater than 40% of their live birth, neonatal deaths occurring in "transfer centers" ("active" relationship), and (3) community hospitals with 40% or less of their live birth, neonatal deaths occurring in "transfer centers" ("inactive" relationship). Only hospitals delivering more than 1000 births per year were examined.

Table V-4 shows that for the four-year period the categories of high-risk center and "active" hospitals had decreases of 19.7% and 40.3% respectively in the neonatal mortality for infants weighing 1001-1500 grams. The "inactive" hospitals showed an erratic pattern with an actual increase in the neonatal mortality rate. The most important finding was that only the "active" hospitals indicated a statistically significant decrease for this high-risk, birth weight group over this time period ($p=.027$).[33]

All three categories had statistically significant improvements for the birth weight group 1501-2000 grams. Although the high-risk centers and "active" hospitals had lower mortality rates, there was not a statistically significant difference among the categories.

TABLE V-4

NEONATAL MORTALITY RATES FOR THE BIRTHWEIGHT GROUP 1001-1500 GRAMS BY HOSPITAL[1] TRANSFER CATEGORY, MASSACHUSETTS, 1971-1974

Hospital Category	1971	1972	1973	1974	Linear Trend Chi Square p
High Risk Center >1000 Del/Yr	418.6 54/129	348.3 31/89	376.1 44/117	336.1 36/107	.250
"Active" >1000 Del/Yr >40%	558.1 24/43	466.7 14/30	361.1 13/36	333.3 12/36	.027
"Inactive" >1000 Del/Yr ≤40%	361.9 38/105	487.2 57/117	271.9 31/114	400.0 46/115	.589
Chi Square among Regions	.10>p>.05	.25>p>.10	.25>p>.10	.75>p>.50	

Source: Vital Events, Office of Health Statistics and Analysis, Massachusetts Department of Public Health

[1]Only hospitals delivering more than 1000 births per year

SECTION C - PERINATAL MORTALITY

Another major objective of the Project was to develop an ongoing mechanism for the collection, analysis and distribution of accurate and useful statistics on perinatal, fetal and newborn mortality and morbidity. The Project has worked with the Office of Health Statistics and Analysis of the State Department of Public Health, the Perinatal Welfare Committee of the Massachusetts Medical Society and other interested groups to develop this type of information. New computer programs have been written to generate data on adequacy of prenatal care, neonatal transfers and mortality rates - including two fetal, two neonatal and four perinatal mortality rates for every city, town and hospital in the State and every census tract in Boston. The mortality statistics are derived from matched birth-death certificates. These programs have been converted for continued use by the Department of Public Health.

There have been dramatic declines in infant, fetal, neonatal and perinatal mortality rates in Massachusetts in recent years. The infant mortality rate has been documented since 1851 and fell from a high of 170.3 (1870-74) to a low of 13.9 in 1974.[70] The rates fell dramatically during the first half of the 20th century from 153.2 at the turn of the century to 22.8 in 1950-54. Following this decline, there was only a 12.7% decrease from 22.8 in 1954 to 19.9 in 1968. However, the rate of decline accelerated again over the next six years as evidenced by a 30.2% decrease in infant mortality from 19.9 in 1968 to 13.9 in 1974. This recent decline is due in part to important clinical and technological advances in perinatal care developed during the 1960's and disseminated over the last 10 years through regional perinatal programs. Other contributing factors include the declining numbers of births (Chapter IV-D), more adequate prenatal care (Chapter V-A), a decrease in the number of low birth weight infants (Chapter V-C) and better technology and availability of family planning and abortion services.

The Massachusetts infant mortality rate (15.3) in 1973 ranked ninth among industrialized countries of the world while the U.S. ranked seventeenth.[71] Only Utah (12.2) and California (13.7) had lower rates. Wisconsin and New Hampshire had the same rate as Massachusetts.[72] In the area of neonatal mortality (<28 days), Massachusetts ranked ninth among the fifty states (10.9) in 1974.[72]

Fetal, Neonatal and Perinatal Mortality Rates (<7 days)

Table V-8 shows the reductions in the fetal, perinatal and neonatal mortality rates for births occurring in Massachusetts hospitals from 1969 to 1974. The reductions were all statistically significant ($p < .003$).[33] The neonatal mortality rate (<7 days) fell by 32% to 9.1, the fetal mortality rate by 43% to 4.5, and the perinatal mortality rate by 36% to 13.5.

TABLE V-8

FETAL, NEONATAL AND PERINATAL MORTALITY RATES

IN MASSACHUSETTS, 1969-1974

Year	Neonatal Mortality Rate[b]	Fetal Mortality Rate[a]	Perinatal Mortality Rate[c]
1969	13.3	7.9	21.1
1970	11.8	7.9	19.7
1971	11.3	5.7	16.9
1972	10.0	5.5	15.4
1973	10.2	6.0	16.1
1974	9.1	4.5	13.5
Linear Trend Chi Square p Value	$<.003$*	$<.003$*	$<.003$*

Source: Massachusetts Department of Public Health Office of Health Statistics and Analysis

[a]Fetal Mortality Rate: [Fetal Deaths (1000+ grams) ÷ Fetal Deaths (1000+ grams) plus Live Births] x 1000

[b]Neonatal Mortality Rate: [Neonatal Deaths <7 Days ÷ Live Births] x 1000

[c]Perinatal Mortality Rate: [Fetal Deaths (1000+ grams) plus Neonatal Deaths <7 Days ÷ Fetal Deaths (1000+ grams) plus Live Births] x 1000

*Indicates Statistical Significance

Reduction in Incidence and Mortality of Low Birth Weight Infants ($\leq$2500 grams).

The percentage of live births that were low birth weight ($\leq$2500 grams) decreased from 7.6% in 1969 to 6.7% in 1974 (Table V-9). This represents a decrease of 34% in the number of low birth weight infants from 1969 to 1974 and means that there were approximately 2,470 fewer low birth weight infants in 1974 than 1969. These 2,470 births applied to the 1974 low birth weight neonatal mortality rate (120.2) would have resulted in 296 more neonatal deaths.

The low birth weight neonatal mortality rate decreased significantly ($p < .003$) from 141.3 to 120.2 from 1969 to 1974 (Table V-9). This represents a 15% decrease. This decrease in the low birth weight neonatal mortality rate has resulted in 102 fewer neonatal deaths in 1974 than would have occurred if the 1969 rates had prevailed.

The percentage of low birth weight newborns decreased for each region in Massachusetts. The greatest decrease in the number of low birth weight infants occurred in maternity service size categories of 501-1000 (33.6%) and >2000 (39.7%). The size category of >2000 births per year consistently had the highest percentage of low birth weight infants. The category $\leq$500 births per year had the lowest percentage of low birth weight infants in 4 out of 6 years. This pattern may reflect a higher percentage of high-risk patients in the service population of large maternity units. It may also reflect the prebooking and referral of high-risk obstretic patients to perinatal centers and this should be encouraged so that high-risk patients are cared for at the appropriate level of care.

The marked improvement in the adequacy of prenatal care from 65% in 1970 to 79% in 1974 has undoubtedly contributed to the improvements in low birth weight incidence and mortality in Massachusetts.

Neonatal Mortality Rates (<28 days) - 1969-1974.

The total <28 days neonatal mortality rate showed a statistically significant decrease ($p < .003$) of 25% from 14.1 in 1969 to 10.6 in 1974 (Table V-9). The reduced neonatal mortality rate of 1974 accounted for 258 fewer neonatal deaths than would have occurred if the 1969 rates were still in effect.

The neonatal mortality rate was then examined by selected birth weight groups.* As Table V-9 illustrates, there was a statistically significant ($p < .003$) decline in neonatal mortality for all of the birth weight groups except 2001-2500 grams and the decrease in this group was nearly significant ($p < .051$).

Birthweight Group (Grams)	% Decrease Neonatal Mortality	Linear Chi-Square p Value
1001-1500	17.4%	<.003
1501-2000	38.7%	<.003
2001-2500	14.6%	.051
≤2500	15.0%	<.003
>2500	26.5%	<.003
Total	25%	<.003

The greatest percentage decrease in neonatal mortality for this six year period was for the 1500-2000 (38.7%) and >2500 (26.5%) birth weight groups. Newborns weighing less than 2000 grams are generally classified as high-risk (Chapter III); and this is one of the high-risk groups that has most benefited from neonatal and perinatal intensive care programs. Over the past decade, considerable emphasis has been placed on early identification and management of these newborns in high-risk centers either through prebooking of high-risk mothers or transfer of high-risk newborns.

TABLE V-9

Live Births, Percent of Annual Births 2500 Grams or Less, Birthweight Specific and Total Neonatal Mortality Rates[a], Massachusetts, 1969-1974

Year	Number of Live Births	Percent Live Births ≤2500g	Birthweight Specific Neonatal Mortality Rates					Total Neonatal Mortality Rate
			1001-1500g	1501-2000g	2001-2500g	≤2500g	>2500g	
1969	95757	7.6	429.8	152.2	27.7	141.3	3.5	14.1
1970	96290	7.4	423.2	143.4	26.6	129.6	3.3	12.9
1971	89337	7.0	411.4	147.9	25.2	136.8	3.0	12.5
1972	79063	7.0	401.0	111.8	21.5	120.3	2.8	11.2
1973	74110	7.1	343.3	89.9	21.9	122.0	2.9	11.5
1974	71777	6.7	355.2	93.4	23.7	120.2	2.6	10.6
p Value -- Linear Trend Chi Square			<.003	<.003	.051	<.003	<.003	<.003

SOURCE: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

[a]Neonatal Deaths <28 Days/1000 Live Births
[b]Only In-Hospital Births Occurring in Massachusetts are Included

*Birth weight neonatal mortality rates are the result of the observed neonatal deaths for a birth weight category divided by the number of live births for that same category and multiplied by 1000.

Neonatal Mortality Rates (< 28 days) by Massachusetts CHP Regions.

The Project analyzed mortality rates by the Comprehensive Health Planning Regions from 1969 to 1974 to determine mortality trends on a regional basis. All regions showed a decrease in total neonatal mortality rates over the six year period. The decrease was statistically significant for each region except for Regions 5 and 6. The most significant decreases were found for Regions 3 and 7 ($p < .003$) (Table V-10).

TABLE V-10

Neonatal Mortality Rates[a] (NMR) for the United States, Massachusetts, and Massachusetts' Regions and Standardized Neonatal Mortality Rates[b] (SNMR) for Massachusetts Regions, 1969-1974[c]

	1969		1970		1971		1972		1973		1974		[d] p Value Linear Trend Chi Square	
	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR		
U.S.	15.6	-	15.1	-	14.2	-	13.6	-	13.0	-	12.1(est)	-		
Mass.	14.1	-	12.9	-	12.5	-	11.2	-	11.5	-	10.6	-	<.003	Mass.
Region 1	13.6	13.3	14.5	13.5	13.0	12.3	10.8	10.9	11.8	11.6	10.5	10.5	.003	1
Region 2	15.7	14.6	13.4	12.9	13.0	12.5	12.3	12.3	13.1	12.2	10.3	9.9	.003	2
Region 3	15.1	15.4	14.4	14.5	10.0	10.9	8.3	8.7	11.2	12.1	10.0	10.2	<.003	3
Region 4	12.9	14.2	12.1	13.0	10.0	10.8	10.1	10.6	10.0	10.5	9.8	9.8	.012	4
Region 5	13.6	14.6	10.6	12.3	11.0	12.2	10.8	11.6	9.1	10.5	11.4	12.9	.072	5
Region 6	13.4	12.4	13.9	12.3	14.3	12.7	12.1	10.9	14.6	12.7	13.0	11.4	.803	6
Region 7	14.9	14.4	11.5	11.9	11.9	12.3	11.2	11.0	8.8	8.8	8.1	8.1	<.003	7
Region 8	14.7	15.0	12.2	12.5	15.0	15.2	12.3	11.7	11.9	12.4	10.2	10.2	.021	8
[d] p Value Chi Square Among Regions	.75>p>.50		.10>p>.05		.01>p>.001		.50>p>.25		.001>p		.05>p>.025			

SOURCES: (1) Massachusetts Department of Public Health, Office of Health Statistics and Analysis
(2) Monthly Vital Statistics Report, Annual Summary for the United States, 1974, National Center for Health Statistics, (HRA) 75-1120 Vol. 23, No. 13, May 30, 1975

[a] Neonatal Deaths <28 Days/1000 Live Births
[b] Direct Standardization to Massachusetts Live Births Less Than and Equal to 2500 Gms and to Those Greater Than 2500 Gms
[c] Only In-Hospital Births Occurring in Massachusetts are Included
[d] p Values Calculated for Neonatal Mortality Rates (NMR) Only

The neonatal mortality rate was also examined in each region by selected birth weight groups. All of the Massachusetts regions showed a decrease in the 1501-2000 gram neonatal mortality rate from 1969-1974; however, the decreases were significant for only Regions 1, 2, 6 and 7. Region 7 had the greatest number of birth weight groups with statistically significant reductions in neonatal mortality.

Region	Birth Weight Groups with Significant ($p < .05$) Decrease in Neonatal Mortality (< 28 days)					
	1001-1500	1501-2000	2001-2500	≤2500	>2500	Total
1	X	X				X
2		X				X
3			X	X		X
4				X		X
5						
6		X			X	
7	X	X		X	X	X
8						X

Only Regions 1 and 7 showed a statistically significant decrease for the birth weight groups (1001-1500 and 1501-2000 grams) most likely to be affected by neonatal intensive care services. The only other regions showing a statistically significant decrease in one of these important groups (1501-2000 grams) were Regions 2 and 6.

Each region should follow its overall neonatal mortality rate and weight specific rates over future years and compare these with State and other regional rates.

Neonatal Mortality Rates (< 28 days) by Size of Maternity Service.

The Project also analyzed neonatal mortality rates by size of maternity service. Maternity services were divided into five size categories by number of deliveries per year. All size categories showed a decrease in neonatal mortality from 1969 to 1974 (Table V-18). The decrease was significant ($p < .05$) for all size categories except 1501-2000 births per year.[33]

Size of Service Births/Year	% Decrease Total Neonatal Mortality	Linear Chi-Square p Value
≤500	29.2%	.019
501-1000	30.2%	<.003
1001-1500	24.6%	<.003
1501-2000	21.3%	.226
>2000	21.9%	<.003
Total	25.5%	<.003

TABLE V-18

Neonatal Mortality Rates (NMR)[a], Standardized Neonatal Mortality Rates[b] (SNMR) by Maternity Service Size, Massachusetts, 1969-1974[c]

Maternity Service Size Births Per Year	1969		1970		1971		1972		1973		1974		p Value[d] Linear Trend Chi Squares
	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR	NMR	SNMR	
≤ 500	13.0	14.0	12.1	13.2	12.8	12.9	9.8	10.0	11.7	11.2	9.2	9.1	p=.019
501-1000	14.9	13.8	13.7	13.4	12.8	12.5	11.8	11.3	11.5	11.8	10.4	10.8	p<.003
1001-1500	14.2	14.9	12.4	12.9	11.2	12.1	11.0	11.3	10.8	11.3	10.7	10.9	p<.003
1501-2000	14.1	14.6	10.8	11.3	11.6	12.5	13.0	13.0	11.7	11.3	11.1	10.6	p=.226
> 2000	13.7	12.8	14.6	13.0	13.9	12.3	9.9	9.3	12.0	11.2	10.7	10.0	p<.003
TOTAL	14.1	--	12.9	--	12.5	--	11.2	--	11.5	--	10.5	--	p<.003
p Value[d] Chi Square Among Categories	.900>p>.750		.01> p>.001		.100> p> .05		.100>p> .05		.975>p>.900		.750>p>.50		

Source: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

[a] Neonatal Deaths <28 days/1000 Live Births

[b] Direct Standardization to Massachusetts Live Births ≤ to 2500 Grams and to those > 2500 Grams

[c] Rates Only for Hospitals with Maternity Services

[d] p Values Calculated for Neonatal Mortality Rates (NMR) only

Although a few studies have found no relationship between size of maternity service and quality of care,[22,74] the majority of studies indicate lower mortality rates and better care capabilities in larger sized units (Chapter IV-C). The greater availability of highly trained personnel and special facilities, equipment and services in larger perinatal units is particularly important for high-risk cases. Therefore, in evaluating perinatal mortality it is essential to control for the mix of high-risk patients. The Project attempted to do this by examining neonatal mortality rates in each size category by specific birth weight groups.

The most important finding in this analysis was that only maternity services with >2000 births per year showed a statistically significant decrease ($p=.02$) in the neonatal mortality rate for one of the highest risk birth weight categories (1001-1500 grams). It is important to note that State Health Department regulations require maternity services with >2000 births per year to provide high-risk, intensive care units which are staffed and equipped to care for high-risk newborns (Table V-20).

TABLE V-20

Neonatal Mortality Rates[a] for the Live Birth Weight Group 1001-1500 Grams

By Maternity Service Size, Massachusetts, 1969-1974

Maternity Service Size Births Per Year	1969	1970	1971	1972	1973	1974	p Value Linear Trend Chi Square
≤500	439.0	448.3	457.1	314.3	514.3	341.5	p=.497
501-1000	437.1	403.0	387.4	410.7	326.9	346.7	p=.087
1001-1500	474.6	494.3	340.9	449.4	318.2	443.0	p=.194
1501-2000	416.7	420.0	540.2	527.0	341.8	369.2	p=.363
>2000	396.5	388.3	385.6	291.3	324.8	292.5	p=.02
TOTAL	429.8	418.2	411.4	401.9	344.1	355.2	p<.003
p Value Chi Square Among Categories	.90>p>.75	.75>p>.50	.10>p>.05	.025>p>.01	.50>p>.25	.50>p>.25	

Source: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

[a]Neonatal Deaths <28 Days 1001-1500 Grams/1000 Live Births 1001-1500 Grams

The size category >2000 births per year also showed statistically significant reductions in neonatal mortality in the greatest number of birth weight groups. These included: 1001-1500 grams, 1501-2000 grams and >2000 grams.

Size of Service Births/Year	Birth Weight Group (grams) with Significant Decrease in Neonatal Mortality				
	1001-1500	1501-2000	2001-2500	>2500	Total
≤500		X			X
501-1000					X
1001-1500		X			X
1501-2000		X			
>2000	X	X		X	X

For the 1501-2000 gram high-risk group, all size categories showed a statistically significant decrease except 501-1000 births per year (Table V-21).[33]

Size of Service Births/Year	% Decrease in Neonatal Mortality	Linear Chi-Square p Value
≤500	65.5%	<.003
501-1000	11.7%	n.s.
1001-1500	30.6%	.005
1501-2000	60.9%	<.003
>2000	41.7%	<.003

The greatest percentage decrease was for the size categories ≤500 births per year and 1501-2000 births per year. These were also the size categories that reported the highest percent of newborns transferred at the time of the team consultation visits (Chapter II-B).

TABLE V-21

Neonatal Mortality Rates[a] for the Live Birth Weight Group 1501-2000 Grams

By Maternity Service Size, Massachusetts, 1969-1974

Maternity Service Size Births Per Year	1969	1970	1971	1972	1973	1974	p Value Linear Trend Chi Square
≤500	192.3	241.9	173.9	156.3	101.7	66.0	p<.003
501-1000	142.9	149.0	147.8	115.1	130.4	126.2	p=.322
1001-1500	177.0	155.0	146.8	113.0	83.3	122.9	p=.005
1501-2000	174.1	108.4	166.7	142.9	71.4	68.0	p<.003
>2000	117.5	147.3	128.7	87.9	57.7	68.5	p<.003
TOTAL	152.2	146.3	147.9	115.8	90.0	93.4	p<.003
p Value Chi Square Among Categories	.25>p>.10	.25>p>.1)	.75>p>.50	.50>p>.25	.05>p>.025	.10>p>.05	

Source: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

[a]Neonatal Deaths < 28 Days 1501-2000 Grams/1000 Live Births 1501-2000 Grams

The mortality rates for other birth weight groups by size category did not show significant reductions.

Perinatal Mortality Rates of the 23 Largest Cities in Massachusetts.

The perinatal mortality rates of the 23 largest cities in Massachusetts were examined for the period 1969-1974 (Table V-17). The following cities were found to have average perinatal mortality rates markedly higher than the statewide rate (17.4) for the six year period 1969-1974:

Boston	21.1
Worcester	22.3
Pittsfield	22.5

The following cities were found to have six year rates markedly lower than the statewide rate:

Brookline	9.8
Newton	10.8
Framingham	12.8
Chicopee	12.9

The statistical significance of the change in the perinatal mortality rate (1969-1974) was analyzed for these cities (Table V-17) using the linear trend chi-square statistic.[33] Significant ($p<.05$) improvements were observed for the following cities:

City	Five Year Decrease	Linear Chi-Square p Value
Lowell	58.0%	<.003
Somerville	50.9%	<.003
Springfield	45.9%	<.003
Boston	39.0%	<.003
Newton	74.4%	.007
Medford	65.9%	.01
Brockton	44.3%	.016
Fall River	36.9%	.021
Lynn	48.8%	.022

The degree of improvement in mortality rates over time should be emphasized as well as the starting, ending and six year average rates. For example, Boston had a high six year average rate, but showed a highly significant improvement. Conversely, if a city had a low rate in 1969, it would be relatively difficult to improve as significantly since there was less improvement to be made.

Special attention should be paid, however, to those cities which exhibited relatively high six year perinatal mortality rates and little improvement over time. Pittsfield, for example, had a high six year average (22.5) and has not improved significantly over time ($p=.298$). Although Worcester had a high six year rate, there is some indication of improvement ($p=.093$) due in large part to a drop of 30.3% in the perinatal mortality rate from 1973 to 1974. It should be noted that a high-risk perinatal center was established in Wocester in 1973.

The Project did not have the resources to do an analysis of the change and relative ranking of the perinatal mortality rates of the 351 cities and towns in the State. It is hoped that the Health Systems Agencies will do this with the data aggregated by the Project in cooperation with the Office of Health Statistics and Analysis of the Department of Public Health.

TABLE V - 17

PERINATAL MORTALITY[1] RATES FOR SELECTED MASSACHUSETTS CITIES,[3] 1969-1974

	1969	1970	1971	1972	1973	1974	Chi	p^2	1969	1970	1971	1972	1973	1974	1969-1974
Arlington	16/802	20/791	13/695	9/616	7/487	10/520	0.93	.352	20.0	25.3	18.7	14.6	14.4	19.2	19.2
Boston	286/11177	262/11312	215/10338	168/8971	168/8213	122/7810	4.88	<.003	25.6	23.2	20.8	18.7	20.5	15.6	21.1
Brockton	36/1773	32/1911	34/1827	21/1734	21/1525	18/1592	2.40	.016	20.3	16.8	18.6	12.1	13.8	11.3	15.6
Brookline	8/547	9/551	1/444	3/379	3/384	2/353									9.8
Cambridge	24/1503	26/1473	22/1318	5/1050	20/1034	7/936	1.67	.095	16.0	17.7	16.7	47.6	19.3	7.5	14.2
Chicopee	12/1127	28/1121	8/1026	11/968	5/890	12/750	1.1	.271	10.6	25.0	7.8	11.4	5.6	16.0	12.9
Fall River	43/1765	35/1804	31/1802	28/1664	22/1606	22/1427	2.3	.021	24.4	19.4	17.2	16.8	13.7	15.4	18.0
Framingham	13/1184	15/1165	17/1123	11/937	7/877	15/801	0.61	.549	11.0	12.9	15.1	11.7	8.0	18.7	12.8
Holyoke	17/868	16/902	19/883	16/751	10/641	12/658	.27	.787	19.6	17.7	21.5	21.3	15.6	18.2	19.1
Lawrence	29/1264	29/1339	29/1428	24/1338	23/1250	18/1238	1.67	.095	22.9	21.7	20.3	17.9	18.4	14.5	19.3
Lowell	52/1901	46/2027	32/1928	38/1772	27/1676	18/1576	3.40	<.003	27.4	22.7	16.6	21.5	16.1	11.4	19.6
Lynn	42/1640	38/1675	31/1561	24/1309	23/1184	14/1072	2.29	.022	25.6	22.7	19.9	18.3	19.4	13.1	20.4
Malden	16/1042	22/1032	18/923	10/803	10/708	12/707	0.55	.582	15.4	21.3	19.5	12.5	14.1	17.0	16.9
Medford	23/1017	15/998	9/861	17/703	3/661	5/654	2.59	.010	22.6	15.0	10.5	24.2	4.5	7.7	14.7
New Bedford	33/1708	26/1609	32/1636	24/1470	27/1483	26/1451	0.163	.873	19.3	16.2	19.6	16.3	18.2	17.9	18.0
Newton	18/1098	12/974	10/850	7/756	5/686	3/720	2.68	.007	16.4	12.3	11.8	9.3	7.3	4.2	10.8
Pittsfield	31/1014	19/901	15/856	16/748	13/698	17/715	1.04	.298	30.6	21.1	17.5	21.4	18.6	23.8	22.5
Quincy	27/1643	27/1592	18/1438	13/1249	17/1059	10/1019	1.45	.147	16.4	17.0	12.5	10.4	16.1	9.8	14.0
Somerville	40/1758	49/1479	27/1428	17/1249	16/1153	11/984	3.65	<.003	22.8	33.1	18.9	13.6	13.8	11.2	19.9
Springfield	54/2814	71/3054	61/3000	33/2603	35/2395	24/2300	3.63	<.003	19.2	23.2	20.3	12.7	14.6	10.4	17.2
Waltham	31/1077	16/1094	16/1020	7/835	15/773	13/701	1.47	.142	28.8	14.6	15.7	8.4	19.4	18.6	17.8
Weymouth	18/952	25/969	15/836	10/779	11/687	13/677	0.91	.363	18.9	25.8	17.9	12.8	16.0	19.2	18.8
Worcester	72/2838	68/2927	59/2725	53/2390	55/2314	37/2235	1.68	.093	25.4	23.2	21.7	22.1	23.8	16.6	22.3

Source: Live birth, death, and fetal death certificates, Office of Health Statistics and Analysis
Massachusetts Department of Public Health

[1] [(Fetal Deaths 1000 grams+) + (Neonatal Deaths <7 Days)/(Live Births) + (Fetal Deaths 1000 grams+)] x 1000

[2] Linear Trend Chi Square

[3] By Residence of Mother

Recommendations - Chapter V

Section A - Prenatal Care

1. The standards of the World Health Organization and the American College of Obstetricians and Gynecologists concerning the minimum number of prenatal visits and the time when care should begin should be used for the analysis of the "adequacy" of prenatal care.

2. The city and town analysis of prenatal care should be continued for as many of the communities in Massachusetts as possible and be used by the Health Systems Agencies in identifying priority areas. Census tract data should also be made available for other cities besides Boston.

3. To assist in the future utilization of these data, the prenatal computer program, developed by the Project, has been converted for use by the Department of Public Health. It is recommended that the data be gathered and analyzed on an annual basis.

Section B - Transfer

1. High-risk mothers should be identified as early as possible in their pregnancy. Appropriate consultation should be obtained and delivery arranged in a high-risk center when indicated. This is particularly important for mothers with potentially high-risk newborns.

2 Community hospitals should identify high-risk newborns as early as possible. Appropriate consultation should be obtained and transfer arranged to neonatal intensive care units when indicated. Early identification and transfer is important in order to obtain maximum benefit.

Section C - Perinatal Mortality

1. The types of data and statistics developed by the Maternity and Newborn Project should be produced on an on-going basis by the Massachusetts Department of Public Health and made available to hospitals, interested organizations and groups throughout the State.

2. The data and statistics generated and converted by the Project should be used by the State Planning Agency, the Health Systems Agencies, Perinatal Centers, the Perinatal Welfare Committee of the Massachusetts Medical Society, the Massachusetts Department of Public Health and other groups to monitor perinatal mortality.

3. In the future, the collection and analysis of race and education specific data should be undertaken. Coding of vital events for census tracts should begin for other cities, in addition to the coding currently going on for Boston.

CHAPTER VI

REGIONAL PERINATAL PROGRAMS IN MASSACHUSETTS

The Project has sought to promote high quality maternity and newborn care, efficient planning and utilization of resources, and a logical distribution of units by size, geographic location and levels of care. The Project has attempted to accomplish these goals through the development of statewide and regional perinatal systems.

Geographic, demographic and regional characteristics are important factors in the regionalization of perinatal care. Massachusetts is a small state which is densely-populated and largely urban. As a result of the Comprehensive Health Planning Act of 1966, the state was divided into eight official health planning regions. Under the recent National Health Planning and Resources Development Act of 1974, these regions have been slightly altered to form six new health planning areas referred to as Health Systems Areas (Appendix VI-A).

Another important factor in regionalization of perinatal care in Massachusetts has been the recognition of different levels of perinatal care. Recently, national definitions and standards for levels of care were developed by the Perinatal Committee.[11] The Project has attempted to build upon and modify these standards so that they are appropriate for the specific needs and conditions in Massachusetts.

1. Level III - High-Risk Perinatal and Neonatal Intensive Care Centers.

An essential core in the development of regional perinatal programs is the establishment of regional high-risk maternity and newborn centers. These centers should be located in natural geographic catchment areas which have a sufficient patient population to support a full range of perinatal services and which provide reasonable access for patients and providers of care.

At the beginning of the Project, there were seven newborn transfer nurseries (neonatal intensive care nurseries) designated by the Massachusetts Department of Public Health. There was also a fairly widespread understanding and acceptance of the concept of early identification and transfer of high-risk newborns. However, the concept of high-risk obstetrical centers and transfer of high-risk obstetrical patients was not equally advanced. Consequently, the Project devoted considerable effort to the development and designation of perinatal centers. These efforts included the drafting of recommended guidelines for the official designation of perinatal centers by the State Health Department, the development of recommended categories of high-risk patients, the circulation of informational materials explaining regionalization and the role of perinatal centers, the development of regional educational programs, and the organization of team consultation visits between high-risk centers and community hospitals and physicians.

At the present time, there are five high-risk perinatal units in Massachusetts in various stages of development. These include: The Wesson Women's Division of the Bay State Medical Center in Springfield (HSA I); the Worcester Memorial Hospital in Worcester (HSA II); and St. Margaret's Hospital, Boston City Hospital and the Boston Hospital for Women (HSA's III, IV, V and VI).

2. Level II - Intermediate Perinatal Care Units.

Massachusetts has a wide variety of maternity and newborn units with varying service capabilities (Chapter II-A). Some of these units have the potential for providing Level II perinatal care as recommended by the Perinatal Committee.[11]

In addition, there are a large number of units capable of providing more than Level I (uncomplicated) care but not the full range of perinatal services expected of Level II. Therefore, the Project recommends a classification of Level II-A and Level II-B units in Massachusetts at this time.

Level II-A perinatal units are units with the potential for providing normal and some high-risk perinatal care. They should have more than 1500 births per year and should provide a special care nursery as defined in existing regulations for high-risk newborns.[15] These units should be designated by the State Department of Public Health.

Level II-B perinatal units are units that provide care for primarily low-risk and normal obstetric and newborn patients, and also have the capacity to handle perinatal emergencies. These units typically do not have the volume of patients or range of services necessary to qualify as a Level II unit as defined by the Perinatal Committee. At the present time, most of the maternity and newborn units in Massachusetts fall into this category.

3. Level I - Uncomplicated Perinatal Care Units.

Level I units should provide only normal perinatal services and should also have the capacity to stabilize perinatal emergencies until patients can be transferred. These units usually are justified only on the basis of geographic isolation or other special conditions (See Chapter IV-C). There are relatively few maternity and newborn services in Massachusetts that can be justified as Level I services only.

Organization of Perinatal Services in Massachusetts

In December 1976, there were 61 operating maternity and newborn units in the State (Appendix VI-B). Table VI-1 presents summary data on relevant indices of perinatal care for these services by the six Health Systems Areas.

TABLE VI-1

Data on Mortality, Transfers, Prenatal Care and Other Relevant Indices of Perinatal Care

		HSA I	HSA II	HSA III	HSA IV			HSA V	HSA VI
Total Population (1970)		805,466	666,124	462,043	2,225,128			864,294	666,115
No. Maternity Units (Dec., 1976)		8	8	6	17			14	8
Total Live Births (1975)		10,174	7,851	6,582	26,902			11,044	7,927
No. Maternity Beds (1975)		184	207	151	635			254	197
Percent Receiving Adequate Prenatal Care					Region III	Region V	Region VI		
	1970	69%	60%	65%	65%	76%	56%	63%	65%
	1974	80%	74%	75%	80%	88%	76%	76%	75%
Neonatal Transfers	1972	57	50	57	36	68	10	124	57
	1974	104	86	75	62	107	49	196	75
Mortality Data									
Neonatal Mortality Rate (<7 days)	1969	13.0	15.06	14.94	14.97	12.18	11.92	14.24	14.94
	1974	8.78	8.49	9.10	7.99	10.0	10.99	7.65	9.10
Fetal Mortality Rate (1000+ grams)	1969	6.5	7.79	8.22	7.85	7.12	8.83	7.3	8.22
	1974	5.42	5.14	4.08	2.96	3.98	3.53	6.01	4.08
Perinatal Mortality Rate	1969	19.42	22.73	23.04	22.70	19.21	20.64	21.44	23.04
	1974	14.16	13.59	13.14	10.93	13.94	14.48	13.62	13.14

HEALTH SYSTEMS AREA I (CHP I)

HSA I is located in the far western part of Massachusetts and is subdivided by the Berkshire Mountains into two sections. The major urban areas are the Springfield-Holyoke SMSA to the east of the mountains, and the Pittsfield SMSA to the west of the mountains. The remainder of the region is composed of smaller communities and rural areas (Appendix VI-A). In December 1976, there were 8 maternity and newborn units in HSA I. There were approximately 184 maternity beds and 10,174 live births occurring in HSA I hospitals in F.Y. 1975 (Table VI-1).

In 1971, the Wesson Women's Hospital in Springfield was officially designated as the regional neonatal trnasfer center. Over the past two years, this unit has expanded to include a full scale service for high-risk fetal-maternal patients. The Center has developed close working relationships with most of the community hospitals and physicians in the region and has provided outstanding leadership in developing an active, regional neonatal and perinatal program - including regional educational programs, consultation services, transport services, and early identification and transfer of high-risk patients.

Therefore, in HSA I there is an active, well-established perinatal center with a well-developed, comprehensive regional perinatal program. The Center serves all of western Massachusetts as well as southern sections of Vermont. It is strongly recommended that all community units participate fully in this regional perinatal program.

There has already been considerable consolidation of maternity and newborn services in HSA I. A decade ago, merger of units in Springfield enabled the Wesson Women's Hospital to develop a broad range of services including a neonatal intensive care unit. This laid the foundation for the first regional maternity and newborn program in the State. Consolidation of units in the northern part of the region has also led to a larger, more comprehensive service for that area.

At the present time, there should be only one high-risk perinatal center in HSA I, the Wesson Women's Division of the Bay State Medical Center. Because of the geographic isolation of the western part of HSA I, it would be ideal to develop a Level II-A unit in this part of the region. At the present time, there is no unit in the western part of HSA I that has either a sufficient volume of deliveries or the range of services necessary to provide Level II-A care. However, a limited Level II capability could be developed if the maternity newborn unit in Pittsfield established a closer working relationship with the back-up services of the perinatal center in Springfield.

The remainder of the maternity and newborn units in HSA I should focus primarily on low-risk and normal perinatal care. Units with less than 1000 deliveries per year should periodically review and justify the continuation of their services as well as the potential for consolidation with other units.

HEALTH SYSTEMS AREA II (CHP II)

HSA II is located in the central part of Massachusetts. The major urban areas are the Worcester SMSA and the Fitchberg-Leominster SMSA. The remainder of the region is composed of smaller communities and rural areas (Appendix VI-A). In December 1976, there were 8 maternity and newborn units in HSA II. There were approximately 107 maternity beds and 7,851 live births occurring in HSA II hospitals in F.Y. 1975 (Table VI-1).

In 1973, the Worcester Memorial Hospital was officially designated as the regional neonatal transfer center. The neonatal intensive care unit at the Memorial Hospital and the regional neonatal program have developed rapidly over the past two years. A complimentary program for high-risk fetal-maternal patients has also begun. The center has established close working relationships with many community hospitals and physicians in Region II.

Therefore, in HSA II, there is a new but dynamic perinatal center with a strong community outreach effort. The center serves all of the central part of Massachusetts. At the present time, there should be only one high-risk perinatal center in HSA II and this should be the Memorial Hospital.

Despite substantial decline in births and underutilization of maternity and newborn services in HSA II, consolidation of units, especially in Worcester, has been relatively slow. Ideally, there should only be one (at the most two) maternity and newborn units in Worcester. If two units continue, their services should be closely coordinated so that they form a single, unified, perinatal program.

There should also be consolidation of maternity and newborn services in the Leominster-Fitchberg-Gardner area in order to build a perinatal service of sufficient size to support a Level II-A unit to serve the northern part of HSA II.

The remainder of the maternity and newborn units in HSA II should focus primarily on low-risk and normal perinatal care. Units with less than 1000 deliveries per year should periodically review and justify the continuation of their services and explore the possibility of consolidation with other services.

HEALTH SYSTEMS AREAS III, IV, V, AND VI (CHP III, IV, V, VI, VII, AND VIII)

The eastern part of Massachusetts presents special problems in developing regional perinatal systems. The multiplicity of high-risk units and their lack of explicit relationships to particular geographic regions has made it difficult to delineate clearcut regional systems. Presently, the eastern part of Massachusetts is functioning as one large region serviced by the neonatal and perinatal high-risk centers located in Boston, Mass. and Providence, Rhode Island.

HEALTH SYSTEMS AREA III (CHP VIII)

HSA III is located in the northeastern part of Massachusetts. The major urban areas are the Lowell SMSA and the Lawrence-Haverhill SMSA, located just south of the New Hampshire border. The remainder of the region is composed of smaller communities and rural areas (Appendix VI-A). In December 1976, there were six maternity and newborn units in HSA III. There were approximately 151 maternity beds and 6,582 live births occurring in HSA III hospitals in F.Y. 1975 (Table VI-1).

There are no officially designated special care, transfer or high-risk perinatal units in HSA III. When consultation or transfer of high-risk cases is considered necessary, individual arrangements are made between the attending physician and high-risk centers in Boston.

HSA III has been relatively inactive in promoting consolidation of services and the development of regional perinatal programs. Presently, there are two choices for this area in terms of regional perinatal care. Under normal conditions, all maternity and newborn services in HSA III are within approximately one hour of the Boston high-risk centers by ground transportation. Thus, one alternative is for units in HSA III to provide only Level I and Level II-B care and to transfer all high-risk patients to perinatal high-risk centers in Boston. In this case, closer working relationships must be developed between community units and perinatal centers in Boston.

On the other hand, climate and congested roads can cause substantial delays in transportation. If consolidation of services could be achieved in either Lawrence or Lowell, a unit of sufficient size and range of services could be created to support a Level II-A or Level III perinatal service. Such a unit would be a valuable resource as a regional perinatal center for HSA III and southern New Hampshire. In this case, more cooperative working relationships would have to be worked out between the perinatal center and other maternity and newborn units in the region.

At the present time, none of the perinatal units in HSA III has a sufficient volume of deliveries or range of services and personnel recommended for the provision of intensive, high-risk perinatal care (Level III or II-A). The two units providing less than 1000 births per year in HSA III should focus primarily on low-risk and normal perinatal care, and they should periodically review and justify the continuation of their services as well as the potential for consolidation with other units.

HEALTH SYSTEMS AREA IV (CHP III, V, AND VI)

HSA IV is the largest HSA in Massachusetts with a population of 2,225,128 in 1970. It is located in the eastern part of the State and includes Boston as well as cities and towns in the western and southern suburbs of Boston. HSA IV and HSA VI comprise the Boston SMSA. The area is primarily urban and suburban (Appendix VI-A). In December 1976, there were 17 maternity and newborn units in HSA IV. There were approximately 635 maternity beds and 26,902 live births occurring in HSA IV hospitals in F.Y. 1975 (Table VI-1).

Six neonatal intensive care units (transfer and special care nurseries) were officially designated in the Boston area as a result of the 1970 State Health Department regulations.[15] Over the years, many of these units have carried out excellent educational, consultation and referral programs. Several are associated with high-risk obstetric services and have developed high-risk perinatal programs. At the present time there are three high-risk perinatal centers in Boston - St. Margaret's Hospital, Boston City Hospital, and the Boston Hospital for Women. The latter involves the high-risk obstetrical service at the Boston Hospital for Women and the Joint Program in Neonatology - a program coordinating the neonatal services of the Boston Hospital for Women, the Children's Hospital Medical Center, and the Beth Israel Hospital. In addition, Boston has two officially-designated, free-standing neonatal intensive care units - the Boston Floating Hospital and the Massachusetts General Hospital.

The Boston neonatal and perinatal intensive care units have developed some working relationships with individual community hospitals and physicians. However, these have largely been on a physician to physician basis, and there has been little multi-institutional, regional perinatal program development in eastern Massachusetts.

One problem has been the lack of cooperation and coordination among the high-risk centers in Boston. A significant step forward was taken in the past two years with the development of the Joint Program in Neonatology. This program combines the high-risk newborn services of the Boston Hospital for Women, the Children's Hospital Medical Center and the Beth Israel Hospital and operates in conjunction with the high-risk maternity services at the Boston Hospital for Women. The Project has supported this effort and tried to encourage similar joint programs among the other high-risk maternity services and transfer nurseries in Boston.

Another important advance has been the formation of the Boston Neonatology Group composed of representatives from all of the transfer and special care nurseries in Boston. Recently, obstetricians have joined the Group. The aim of this Group is to coordinate the activities and programs of the Boston neonatal and perinatal centers.

The Project has attempted to improve the organization of regional perinatal programs in HSA IV and the eastern part of the State in a number of ways. Better coordination and working relationships among the high-risk centers in Boston have been encouraged in order to promote more organized, on-going programs of education, consultation, transfer, evaluation and other services for community maternity and newborn units. The Project has also attempted to initiate and strengthen more formal working relationships between high-risk centers in Boston and individual community hospitals.

There has been considerable consolidation of maternity and newborn services in HSA IV. However, efforts to promote constructive consolidation of units delivering less than 1500 births per year should continue, especially in Cambridge, Brighton, Natick, Newton and Waltham. In this highly urban area, there is no

justification for units delivering approximately 500 births per year or less, and these units should make plans to consolidate as soon as possible.

In summary, HSA IV has well-established, excellent neonatal and perinatal intensive care centers located in Boston. Units in HSA IV that deliver over 1500 births per year, and are not designated as high-risk centers, should develop comprehensive perinatal services in order to become Level II-A facilities. All other units in HSA IV should provide primarily low-risk and normal perinatal care. Units with less than 1000 births per year should periodically review and justify the continuation of their services as well as the potential for consolidation with other units.

HEALTH SYSTEMS AREA V (CHP VII)

HSA V is located in the southeastern part of Massachusetts and borders on the State of Rhode Island. There are four major urban areas in HSA V: the Brockton SMSA; the Fall River SMSA; the New Bedford SMSA; and the Bristol County portion of the Providence, Rhode Island SMSA. The remainder of the area is comprised of small communities and rural areas (Appendix VI-A). In December 1976, there were 14 maternity newborn units in HSA V. There were approximately 254 maternity beds and 11,044 live births occurring in HSA V hospitals in F.Y. 1975 (Table VI-1).

There are no perinatal intensive care units within HSA V. However, the perinatal center in Providence, Rhode Island, has an active community outreach program and has become a resource for high-risk perinatal care for parts of southeastern Massachusetts. In addition, a limited special care nursery was established in 1971 at St. Anne's Hospital in Fall River. A few maternity and newborn units in HSA V have established working relationships with high-risk perinatal and neonatal centers in Boston. Many units, however, simply seek consultation and transfer on an ad hoc basis when special problems arise.

Consolidation of maternity and newborn services in HSA V has been a slow process and has impeded the development of a regional perinatal center and a regional perinatal program in this area. Two units in Fall River have recently merged and may result in a service that could qualify as a Level II-A unit. In this case, the location of the existing special care nursery should be reevaluated. Ideally, all units in Fall River should merge. Further consolidations are possible in other areas of HSA V, such as the Brockton-Stoughton area, and might enable these units to develop Level II-A capabilities. The perinatal unit in New Bedford already has a sufficient volume of cases and should develop a full Level II-A service.

If additional consolidation is achieved, a regional perinatal center might be developed to serve HSA V at some future date. At the present time, it is recommended that maternity and newborn units in HSA V develop close working relationships with neonatal and perinatal centers in Boston and Providence, Rhode Island, for high-risk care.

All other units in HSA V should provide primarily low risk and normal perinatal care. Units with less than 1000 deliveries per year should periodically review and justify the continuation of their services as well as the potential for consolidation.

HEALTH SYSTEMS AREA VI (CHP IV)

HSA VI is located just north of Boston and comprises the northern part of the Boston SMSA. The southern part of the region borders the City of Boston and is highly urban, while the remainder of the area is composed of smaller communities (Appendix VI-A). In December 1976, there were 8 maternity and newborn units in HSA VI. There were approximately 197 maternity beds and 7,927 live births in fiscal year 1975.

There are no high-risk perinatal centers in HSA VI. All of the maternity and newborn units in this area are within 30 to 60 minutes from Boston by ground transportation under normal conditions. Community physicians, hospitals and the Health Planning Agency in HSA VI have provided leadership in regionalization of maternity and newborn care. Most units have developed close working relationships with the high-risk perinatal and neonatal units in Boston, including educational programs, consultation and transfer of high-risk patients when indicated.

In recent years, there has been active consolidation of maternity and newborn services in HSA VI. Additional consolidation is possible in the Beverly-Danvers area.

Due to the close proximity to Boston, HSA VI should continue to relate to the neonatal and perinatal centers in Boston for intensive maternity and newborn care. However, it would be advantageous for one of the larger units (over 1500 births per year) to develop a full Level II-A capability. This would enable some high-risk patients to be cared for within the region.

Other units in HSA VI should focus primarily on low-risk and normal perinatal care. Units with less than 1000 deliveries per year should periodically review and justify the continuation of their services as well as evaluate the potential for consolidation with other units.

CONCLUSION

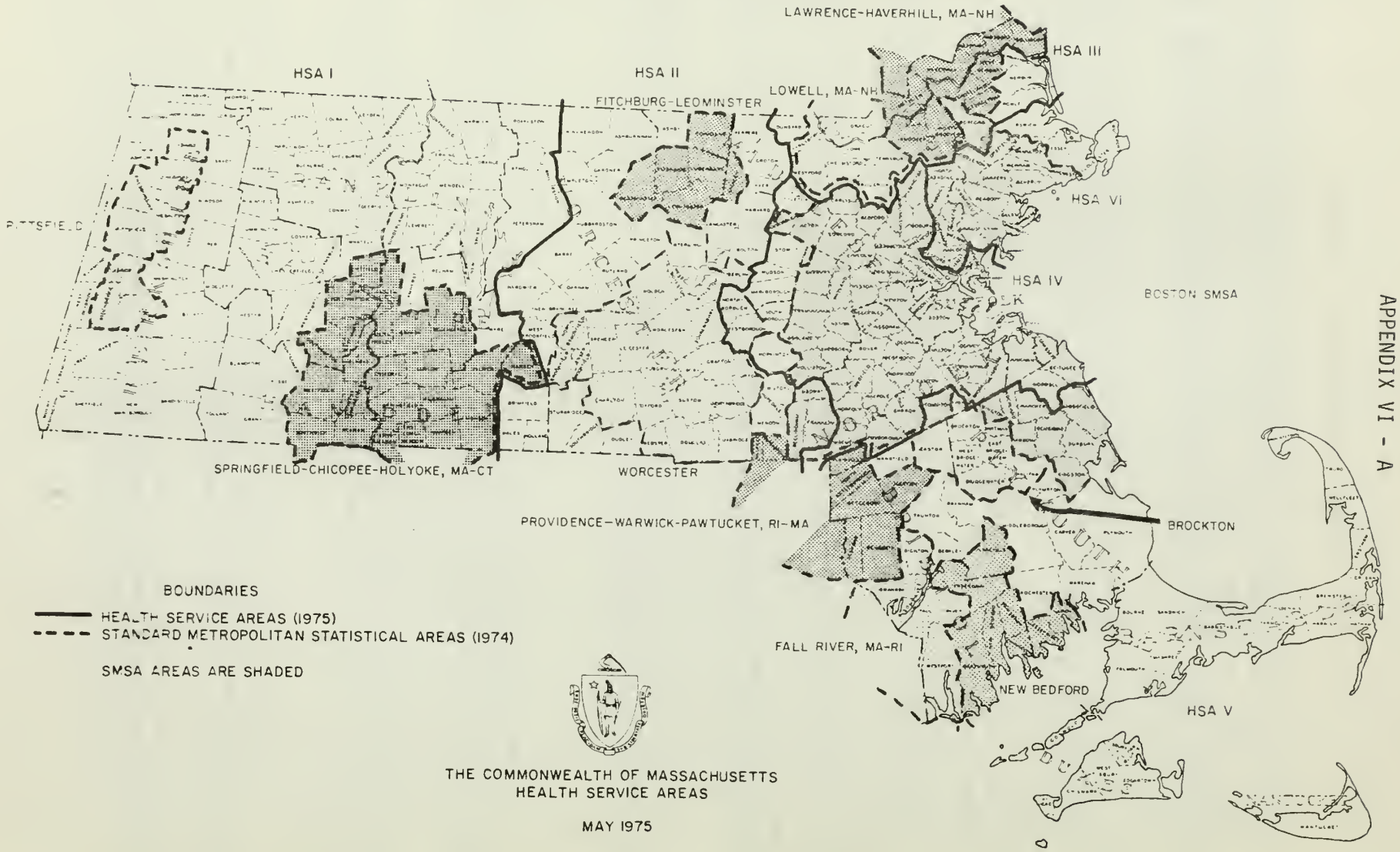
At the present time, every region of the State has access to a perinatal and neonatal intensive care unit within a reasonable distance. Most community hospitals have developed working relationships with at least one high-risk center although these need to be improved in many places.

Additional consolidation is needed in some regions to eliminate unnecessary duplication or to establish units of sufficient size to provide needed Level II-A services. Units delivering approximately 500 births per year or less should consolidate as soon as possible unless they serve geographically isolated populations or can justify their services on some other basis (Chapter IV-C).

In each region, the perinatal centers, perinatal services in community hospitals, and the Health Systems Agency should work together to develop a plan for the optimal distribution of maternity and newborn units by size and level of care. The types of patients cared for by each unit should be commensurate with the range of services and clinical capabilities of the unit. Community services and high-risk centers should develop close working relationships to evaluate service capabilities and to determine the best management for high-risk patients.

MAP C

SMSA AND HEALTH SERVICE AREA BOUNDARIES



THE COMMONWEALTH OF MASSACHUSETTS
HEALTH SERVICE AREAS

MAY 1975

APPENDIX VI-B

MASSACHUSETTS LIVE BIRTHS, 1974 FY, 1975 FY[1]

REGION I (HSA I)

1. Berkshire Medical Center - 1,259 (1,290)
2. Cooley Dickinson - 764 (976)
3. Fairview - 135 (131)
*4. Farren - 450
5. Franklin County - 473 (815)
*6. Holyoke - 203
*7. Noble - 408 (10)
8. North Adams - 543 (531)
9. Providence - 1,413 (1,702)
10. Wesson Women's Division of the Medical Center of Western Massachusetts - 4,249 (4,400)

REGION II (HSA II)

11. St. Vincent's - 771 (820)
*12. Athol - 141 (25)
13. Burbank - 966 (901)
14. Harrington - 453 (556)
15. Henry Heywood - 358 (352)
*16. Hubbard Regional - 204 (48)
17. Leominster - 718 (930)
18. Mary Lane - 354 (319) (HSA I)
*19. Worcester City - 428 (399)
20. Memorial - 1,583 (1,711)
21. Milford-Whitinsville - 486 (414)
22. Worcester Hahnemann - 1,737 (1,695)

REGION III (HSA IV)

23. Cambridge - 738 (772)
*24. Choate - 569 (488)
25. Emerson - 1,017 (1,172)
26. Mount Auburn - 709 (691)
27. Symmes - 330 (319)
28. Waltham - 742 (717)
29. Winchester - 952 (1,056)

REGION IV (HSA VI)

30. Beverly - 588 (577)
31. Addison-Gilbert - 359 (338)
32. Hunt - 452 (477)
*33. Lawrence Memorial - 402 (325)
34. Lynn - 1,352 (1,368)
35. Malden - 1,527 (1,617)
36. Melrose-Wakefield - 1,383 (1,549)
37. New England Memorial - 411 (469)
38. Salem - 940 (952)
*39. Saugus General - 97 (39)
*40. Union - 364
*41. Whidden - 330 (216)

REGION V (HSA IV)

42. Framingham Union - 1,577 (1,600
43. Leonard Morse - 592 (694)
*44. Marlborough - 459 (372)
45. Newton-Wellesley - 978 (1,045)
46. Norwood - 1,292 (1,186)
47. Quincy City - 1,220 (1,210)
48. South Shore - 1,677 (1,674)

REGION VI (HSA IV)

49. Beth Israel - 2,335 (2,152)
50. Boston City - 1,296 (1,598)
51. Boston Hospital for Women Lying-In Division - 5,946 (6,028)
52. St. Elizabeth's - 1,057 (1,121)
53. St. Margaret's - 3,318 (3,007)

REGION VII (HSA V)

54. Brockton - 1,002 (1,024)
55. Cape Cod - 822 (794)
56. Falmouth - 464 (454)
57. Goddard - 1,551 (1,687)
58. Jordan - 548 (524)
59. Martha's Vineyard - 107 (99)
60. Nantucket Cottage - 73 (54)
61. Morton - 711 (765)
62. St. Ann's - 838 (745)
63. St. Luke's (New Bedford) - 2,106 (2,004)
*64. St. Luke's (Middleboro) - 290 (214)
65. Sturdy - 877 (941)
66. Tobey - 275 (270)
+(67. Truesdale - 721 (727)
68. Union - 725 (742)

REGION VIII (HSA III)

69. Anna Jacques - 510 (592)
70. Bon Secours - 1,353 (1,344)
71. Hale Haverhill Municipal - 808 (871)
72. Lawrence General - 1,235 (1,240)
73. Lowell General - 1,463 (1,429)
*74. St. John's - 488
75. St. Joseph's - 825 (1,106)

Source: Massachusetts Department of Public Health, Office of Health Statistics and Analysis

*Closed maternity service since 1974

+Hospitals merged, neither service closed

[1]1975 FY births in parenthesis

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